Application for the President's Quality Award Program

1996

National Aeronautics and Space Administration

John F. Kennedy Space Center

September 1995

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
SEP 1995		**00-00-1995 to 00-00-1995**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Application for the President's Quality Award Program 1996	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Kennedy Space Center,National Aeronautics and Space Administration,Kennedy Space Center,FL,32899-0001**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

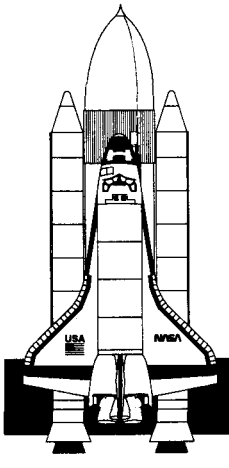
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**63**	

National Aeronautics and Space Administration

John F. Kennedy Space Center

OVERVIEW

Center Director:	Jay F. Honeycutt
NASA Employees:	2,200
Contractor Employees:	12,000
FY95 Budget:	1.3 Billion
KSC Acreage:	140,000
Building Area:	Over 8 million square feet
Water:	3 pump stations; 67 miles of distribution lines
Sewage:	8 treatment plants; 54 lift stations; and 13 miles of line
Electrical Power:	2 primary, 325 secondary substations; and 270 miles of distribution lines
Air Conditioning:	31,000 tons
Roadways:	192 miles (158 paved)
Waterways:	19.3 miles of navigational channels with 1,578 feet of dock facilities
Bridges:	4 draw spans; 4 systems
Ships:	2 Booster Recovery Ships
Aircraft:	4 Helicopters, 1 Fixed Wing
Runway:	15,000 feet in length (Shuttle Landing Facility)



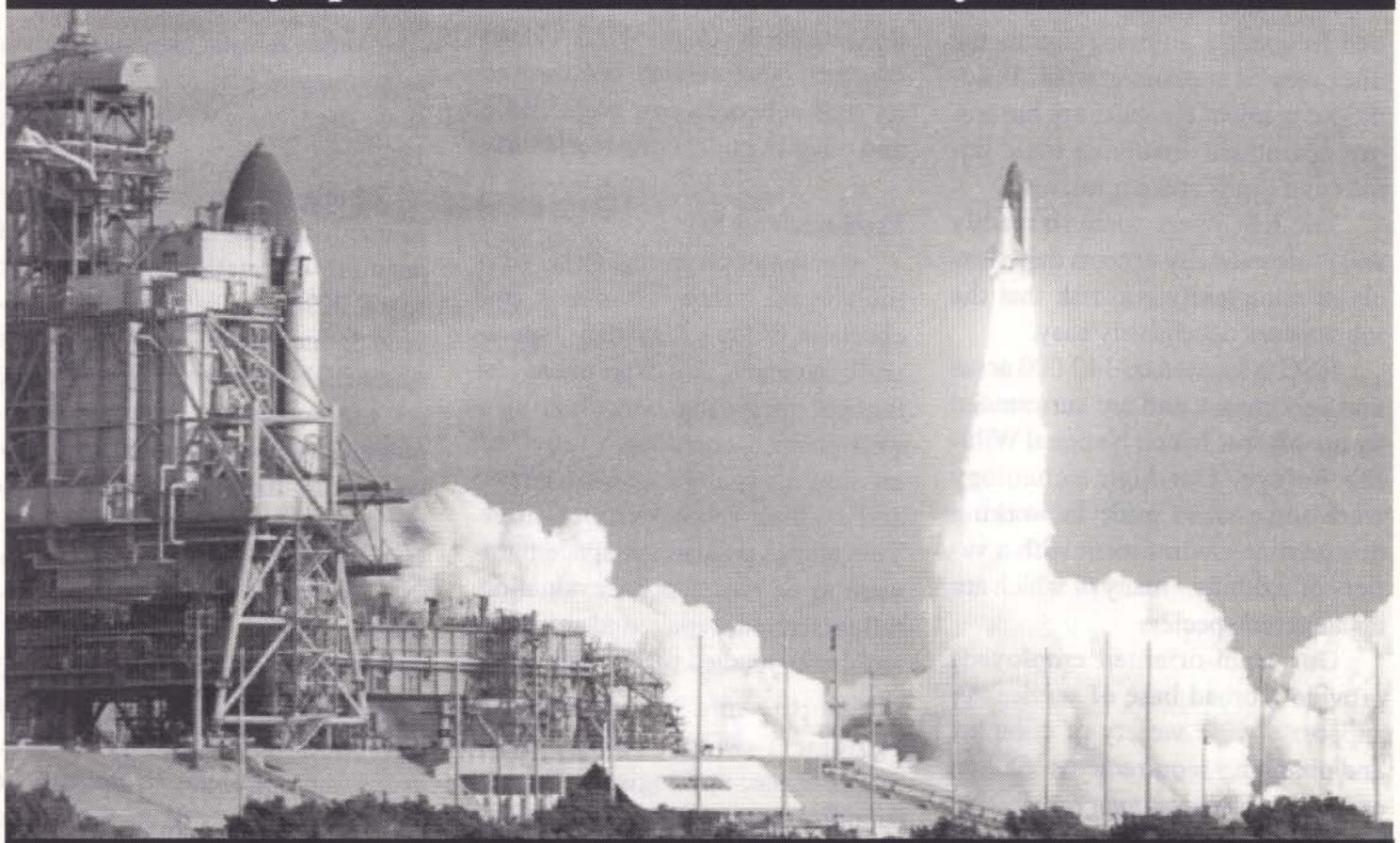
Cover: *This Tracking and Data Relay Satellite (TDRS) in the Orbiter Payload Bays, is one of four satellites in a constellation that provides communications and tracking services for the Space Shuttle and other NASA satellites on-orbit. The TDRS satellites are representative of the payloads that we perform pre-flight processing, integrate into the Space Shuttle Orbiters and launch to orbit from the Kennedy Space Center. Our ability to improve TDRS processing is discussed in Sections 5 and 6, and our customer's satisfaction with our work is described in Section 7.*

SPACE SHUTTLE

Table of Contents

ORGANIZATIONAL OVERVIEW

Kennedy Space Center - America's Gateway to the Universe



Leading the World in Preparing and Launching Missions to Earth and Beyond

Mission

The John F. Kennedy Space Center (KSC) is the National Aeronautics and Space Administration's (NASA's) world class launch and payload processing operations Center. It is home to the Space Shuttle fleet, which transports astronaut crews and a wide variety of payloads into earth orbit and beyond and prepares for their return. KSC also provides support for launch activities at Cape Canaveral Air Station, Florida, and Vandenberg Air Force Base, California, and for worldwide contingency and secondary Space Shuttle landing sites.

The KSC team[1] is responsible for the preparation, launch, landing, and recovery of the Shuttle orbiters, crews, and payloads as well as the recovery of the reusable solid rocket boosters. Our accomplishments reflect our commitment to individual and collective excellence.

With literally thousands of components that must operate in perfect unison during launch and orbit, the Space Shuttle is admittedly the most complex machine ever built. After more than a decade of Shuttle missions, human space flight remains an extremely risky enterprise. The astronauts, one of our internal customers, face this risk and trust the KSC team with their lives to maintain and launch this incredible space vehicle for each mission.

Similarly, the KSC processes for "preparing and launching missions to earth and beyond" are among the most complex and risky in the world. The KSC team deals with this complexity and risk on a daily basis. The task for orbiter processing is illustrative of the magnitude of the work in the preparation of an Orbiter in its "hangar," the Orbiter Processing Facility (OPF). Processing requires the scheduling of over 1,500 tasks with nearly 20,000 constraints that must

be satisfied before the work is complete. When three Orbiters are being processed simultaneously, which is usually the case, over 4,500 tasks and 60,000 constraints are orchestrated and frequently adjusted due to the discovery of unplanned work. In addition, many of the tasks are hazardous operations, involving toxic liquids and gases and explosives.

The KSC work force so readily and professionally accepts these levels of complexity and risk that the job appears deceptively easy.

KSC is located on 140,000 acres that encompass and are surrounded by the Merritt Island National Wildlife Refuge. Our high technology work force takes pride in working this pristine environment with a variety of wildlife – many of which are endangered species.

Our team-oriented employees provide a broad base of services to support a wide variety of complex and changing requirements. Safety, excellence, and customer satisfaction are key to the fulfillment of our mission.

More than 75 percent of our 2,200 NASA employees are engineers and scientists or are in other professional disciplines.

An important responsibility includes managing an annual budget in excess of $1,300,000,000 and a team of contractors, who are a vital component of the nation's space program.

The total KSC population of approximately 14,000 includes NASA, major contractors, subcontractors, and tenant organizations that comprise the most complex and the largest contractor work force of all the NASA centers.

Integrated teams of NASA and contractor personnel work with a variety of space and ground systems hardware and software. There is an extensive flow of tasks and requirements across a network of partners, customers, and supplier organizations within the Center, NASA Headquarters, other centers, our contractor and subcontractor work force, and other organizations worldwide.

Products and Services

Our major products and services include the preparation, test, and checkout of launch systems, spacecraft, payloads, and experiments for launch, including coordinating a well-planned countdown to ensure mission safety and success in launch and landing recovery operations. This allows postlaunch space hardware to be returned for evaluation, refurbishment, repair, and servicing and can be readied for another flight.

Facility and ground support equipment design, construction, maintenance, and logistics are key support services. These services include research and development activities for science, engineering, and technology application to enhance the safety, reliability, efficiency, effectiveness, and quality of KSC activities while fostering new ideas for Continual Improvement (CI).

Products and services provided for internal customers include planning, designing, operating, and maintaining the Center's power and lighting, water and sewage systems, waste disposal, heating, air conditioning, communications, buildings and structures, library, office automation, fire, security, law enforcement, aircraft and railroad operations, transportation, roads and grounds maintenance, food services, mail, child care center, credit union, emergency medical, and most other services required for a small city.

History of KSC Quality Management

Quality management has evolved as an integral part of our operations since the Center was established in 1962.

Challenged by President John F. Kennedy to enter the space race and promote our nation's presence in space, KSC was established to provide launch services for manned space flight. Our heritage is founded on management through well-planned and well-documented processes that meets our customer requirements, ensures customer satisfaction, and builds close relationships with our customers and suppliers.

The KSC commitment to excellence evolved from a tradition of success built over a period of three decades and continues to improve to meet today's increased variety of customers and their unique needs.

Top KSC executives recognized that we should improve our quality and procedures, while emphasizing safety as the number one priority. Initial improvement activities focused on four areas: (1) to reduce the number of Shuttle and payload processing activities, (2) to strengthen the partnerships with our customers and suppliers, (3) to expand employee empowerment, and (4) to use the CI process to accomplish these changes.

The first formal KSC Strategic Plan was developed in the fall of 1987, addressing the future of KSC as an integral part of our Nation's pursuit of civil space initiatives. During this period, we focused on the

safe return of the Space Shuttle to flight status and on strengthening the management and technical teamwork associated with our missions.

In late 1990, our quality improvement efforts accelerated significantly and Total Quality Management (TQM) became a key element in accomplishing our mission. Management-sponsored briefings were presented at KSC by Philip Crosby (Philip Crosby Associates), Tina Sung (Federal Quality Institute), and Malcolm Baldrige winners David Kearns (Xerox) and Chris Holloway (Milliken). We used these sessions to educate, motivate, and help foster the TQM commitment by management.

In 1991, KSC contracted with the Cumberland Group, a national consulting firm experienced in working with government and the aerospace industry, to provide the basis for our implementation of TQM as well as extensive employee and management orientation and training. Workshops began with presentations to top management and cascaded down throughout all levels of the organization.

By the end of 1991, more than 80 percent of our employees had participated in workshops and received training in CI. The workshops included developing a mission, a vision, and value statements and overall TQM implementation planning. Subsequent workshops were conducted for new employees and those previously unable to attend.

The Strategic Plan was rewritten in 1991 with more specific goals and an added emphasis on TQM as a way of doing business. A Kennedy Management Instruction on TQM was implemented in 1991 and revised in 1992 to reflect these changes. We recognized that quality management is an integral part of the CI program and that our objective is to improve our processes and not just fix the problems. Therefore, at KSC we have elected to use CI as being synonymous with TQM.

In 1993, a NASA team developed a new mission statement with input and support from our employees, customers, and suppliers. Another team formulated a new Strategic Plan for 1994, building on our new mission statement and using input from management, employees, contractors, customers, and suppliers. A third team developed a CI Plan. Our goal is to merge the two plans into one document during the 1995-96 update cycle. The goals and objectives of the KSC Strategic and CI Plans are supported by the vision, goals, and objectives contained in the CI plans of the various KSC subordinate organizations.

KSC participated in a NASA internal assessment using the President's Award criteria in 1990. At that time, management decided we were not ready to submit that application. In 1993, Robert L. Crippen, then Center Director, wanted an external assessment of our progress in the implementation of CI, and we applied for the Quality Improvement Prototype Award and were named a finalist.

As a result of our internal self-evaluation and the assessment and feedback from the Federal Quality Institute examiners, we have implemented changes and have made notable progress in our continual improvement effort. The examiners stated that we have strengths in all areas, have a strong vision of our role, and have pride in our organization, in the quality of our people, and in our work.

The results of the internal and external assessments have now paid dividends, highlighted by KSC receiving the 1995 President's Quality Improvement Prototype Award and also being named a finalist for the Florida Governor's Sterling Award.

Customers

We have a diverse group of customers and stakeholders in private industry, academia, and the public sector. We recognize that suppliers and customers often exchange roles during a process. KSC's principal customers are the international science community; the astronauts who fly on the Shuttle; other NASA centers whose hardware and software become a part of our mission; the media; Congress and the Executive Branch; local, state, and Federal regulatory agencies; industry and academia; our own employees; and ultimately the American taxpayer.

The principal customers for KSC, identified for reporting purposes for the National Performance Review (NPR) Reinvention Laboratory, include our direct Shuttle and payload processing customers and the general public. Our direct payload customers include universities, industry, other NASA centers, other government agencies, and international customers. Information is provided to national and international media, launch and landing guests, educational institutions, teachers and students, and Spaceport USA visitors.

Customers' Quality Requirements

Our continued success is in our ability to understand and respond to customer requirements. Employees

at all levels of the organization are involved in evaluating customer feedback and prioritizing customer needs.

We have determined that our customers' quality requirements and standards include safety, on-time delivery, meeting specifications, uninterruptible service, on schedule operations, cost control, short turnaround time, accuracy, well-planned recycle time, responsiveness, and effectiveness.

Types and Numbers of Principal Suppliers

Our principal suppliers are a combination of the country's largest corporations (such as McDonnell Douglas Space Systems; Lockheed-Martin; EG&G Florida, Inc.; Rockwell International; Northrop-Grumman; Thiokol; USBI; and Harris) as well as many small and mid-size businesses including minority and women-owned businesses. More than 50 KSC contractor organizations perform diverse activities such as preparing the Space Shuttle for flight, preparing and performing safety analysis of critical devices, operating the KSC employee child care center, and providing educational outreach activities.

Our contracts range from an operations support services contract for $17 million, held by an Alaskan Native-American owned company, to a $1 million contract for installation of underground conduit held by a woman-owned small business in Merritt Island, Florida. The KSC team has won the Eisenhower Award for small business excellence in 1993 and 1994.

We communicate quality requirements to our prime contractors and suppliers and set quality goals including the involvement of small businesses and small disadvantaged businesses. Our Procurement Office and the Quality Assurance and Mission Assurance offices of the Safety and Mission Assurance Directorate oversee our prime contractor's purchasing systems to ensure that quality requirements are communicated and that vendor quality is measured and assessed for continual improvement.

Laws and/or Regulations That Significantly Affect Operations

We are committed to living up to the most restrictive regulations and performing as a responsible and contributing member of the community. The most common and significant regulations deal with environmental protection, safety, health, building, transportation, and procurement issues, which are monitored by Federal Regulatory Agencies such as the Environmental Protection Agency, the Federal Aviation Administration, the Department of Transportation, the Occupational Safety and Health Administration, and the State Department under the United States Code and the Code of Federal Regulations. Florida regulatory agencies include the Departments of Agriculture, Environmental Protection, and Transportation.

Major New Thrusts or Challenges Facing KSC

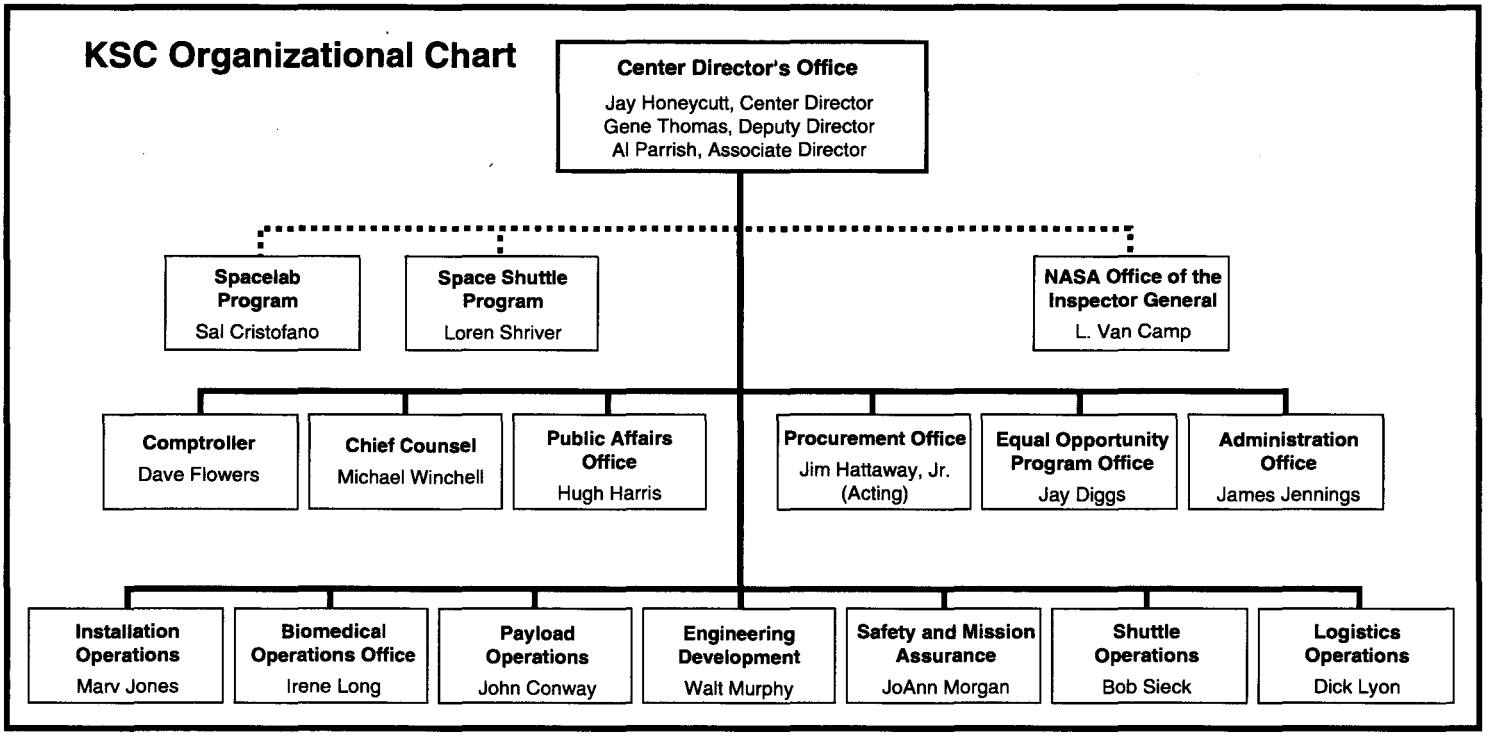
In the present political environment embracing a strong policy to reduce government, balance the Federal budget, and privatize to the maximum extent, KSC faces many major challenges. We must adapt to a new way of managing our resources and a new role for civil servants in NASA. In all of our programs, we continue to stress a firm commitment to safety as our number one priority.

In 1995, we faced the challenge of international cooperation in space. The Russian Mir station visit by the Shuttle orbiter was a flawless mission. KSC's teamwork with its Russian counterparts was an example of international customer relationships in total accord. Our commitment to teaming as a standard practice worked extremely well as the Russian and American ground crews shared in the successful integration of the Russian hardware into the orbiter. Our quality management process has allowed us to face this challenge with outstanding success.

In the last half of this decade, KSC, with its veteran management staff, and its exemplary launch and landing processing team face their toughest challenge since the birth of NASA in October 1958. The President and the Congress have mandated that the Shuttle program be privatized. This privatization means a prime private aerospace company will take control of the Shuttle program with NASA being relegated to a "caretaker" role. KSC faces a reduction of its civil service work force by one-half. Several thousand contractor employees will also be reduced across the program. KSC management and employees must define and implement new ways of doing business. NASA employees will transition from a "world leader" mentality to an "observer" status. Our business will be to survey and audit private contractors while maintaining a confidence that the space vehicles and payloads are ready to fly. A literal host of paradigms must change! Safety must not be compromised.

In light of this new direction to privatize, our KSC team has recommitted to excellence in the quality of our products and services for our customers. With diminishing roles, morale often becomes a problem as employees see their responsibilities subjugated. Our most significant challenge is to maintain our quality management structure, to keep our employees motivated to be the very best, and to carry on the KSC standard of excellence.

We are confident that we will change as our challenges dictate. The human elements of trust, ethical behavior, and a strong commitment to our goals are still prevalent characteristics of our employees. The pride in which we do our launch and landing job has not been compromised by temporary setbacks. The employees of KSC are equal to the challenges, and our strong record of successes will continue to make our nation proud of the accomplishments of the employees of the Kennedy Space Center.



[1] KSC Team = NASA Civil Service + Contractor Employees. NASA Team = Civil Service Employees.

1.0 LEADERSHIP

1.1 Senior Executive Leadership

I am asking each of you to "walk and talk" the same quality story that got us where we are today. We have always presented Continual Improvement as our way of doing business and we will continue to strive to do things "better, faster and cheaper."

(Jay Honeycutt, KSC Director)

1.1.a

The Kennedy Space Center's three top executives, Center Director Jay Honeycutt, Deputy Director Gene Thomas, and Associate Director Al Parrish, have demonstrated their personal commitment to sustaining KSC as a customer-focused organization devoted to Continual Improvement (CI) as a way of doing business. In fact, senior executives throughout KSC exhibit their commitment to: (1) creating and reinforcing values and expectations throughout KSC's leadership system, (2) setting directions and performance excellence goals through strategic and business planning, and (3) reviewing overall organization performance, including customer-related and operational performance. Evidence of leadership commitment to each of these areas is described throughout this application.

Creating and Reinforcing Values and Expectations Throughout KSC's Leadership System

KSC leaders believe that having a clear set of quality goals and setting expectations for employees are crucial steps in managing any organization. Robert Crippen, the previous Center Director, formed a vision team, a strategic planning team, and a CI planning team. These efforts brought employees' thoughts and ideas into the planning process to encourage ownership of KSC's mission, vision, and goals for the future. In essence, these teams created the plans to achieve these goals. All senior managers showed their support of these plans by signing expressions of commitment and by requiring their organizations to develop and implement supporting plans.

Commitment of KSC management to quality is reflected through their consistent and widespread communication of quality values, both inside and outside the organization, using a variety of forums. For example, the KSC CI Steering Committee, composed of key first-level directors, meet to evaluate and improve CI processes and progress.

A joint NASA/Contractor Integrated Working Group, composed of members of the CI Steering Committee and the general managers of key contractor organizations, meets every six weeks to communicate quality results and applaud and share results of integrated team successes.

The Center Director's Information Exchange Forum meetings are held quarterly where Jay, Gene, and Al meet with employees from various organizations who serve a one-year term to interface directly with senior management.

In addition, Jay and all senior executives conduct "all-employee" meetings to personally communicate their quality values and to emphasize the need for total employee involvement in the quality processes. Executive-level directors have established employee steering committees to formulate policy and set direction for CI initiatives, establish priorities for improvement projects, and direct customer focus within their organizations. Further, midlevel managers and supervisors communicate goals for mission success, encouraging employee action, ensuring customer satisfaction by working the improvements, and recognizing employee performance.

Organizations external to KSC witness KSC's commitment to quality through managers and employees forming community partnerships with schools, industry and other organizations, serving on NASA and other government and industry committees, presenting papers at conferences, booking various speaking engagements throughout the local community and the United States, and participating in small business expositions and the annual Combined Federal Campaign.

Our senior executives are committed, personally involved, and visible as advocates for a quality organization. For example, Gene Thomas, Deputy Center Director, received the NASA Equal Opportunity Award in 1994 as the leader in equal opportunity planning and education for the Agency and for the Federal government.

During a recent celebration of the NASA Heroes of Reinvention, held at NASA Headquarters, where Vice President Gore said, *"Jay Honeycutt's Shuttle team and John Conway's payload customer support team have really been making things work better and cost less. In the last few years, the Shuttle team, including a terrific group of contractors led by Lockheed, has cut the cost of each*

flight by $43 million. They get the Shuttle assembled and on the launch pad 40 percent faster with one-third as much labor. This all adds up to a savings of $340 million per year. And, quality and safety are way up at the same time."

The improvements cited are a direct result of NASA and contractor executive management's creation and reinforcement of values and expectations throughout the organization's leadership system and focus on process performance.

Setting Directions and Performance Excellence Goals Through Strategic and Business Planning

KSC's executive management establishes direction and performance excellence goals through strategic planning. KSC was the first in NASA to have employees develop a vision statement and serve as key contributors to the latest agency mission and vision statements. A strong, active participation of all directorates in conjunction with the efforts of JoAnn Morgan, Director of Safety Reliability, and Quality Assurance and the Strategic Plan team leader, was a key ingredient in making this plan a huge success. JoAnn's personal commitment was an inspiration to the team members and enabled them to produce a quality plan for the Center. The KSC strategic planning process and its implementation are discussed in Section 3.

The KSC vision is: *"Kennedy Space Center, America's Gateway to the Universe, Leading the World in Preparing and Launching Missions to Earth and Beyond."*

The KSC Strategic and Continual Improvement Plans, which are being integrated, focus on KSC's customers. The plans encourage a progressively higher standard of customer service, define quality through the eyes of the customer, and stress the need to meet or exceed customer expectations.

All KSC organizations have developed supporting mission and vision statements and CI plans to reflect a more specific customer focus.

Sample organizational vision statements are shown below.

Shuttle Processing Team Vision

The Shuttle Management Team exists to process and launch the Space Shuttle for the customer. We strive to meet and exceed the goals of our customers by consistent commitment to provide teamwork, innovation, and engineering expertise. Our team pledges the highest level of performance at the lowest possible cost within the framework of absolute dedication to safety and quality to meet the nation's space initiatives and challenges of today and the 21st Century.

Payload Processing Team Vision

To be the world's best organization for assembly, test, checkout, and integration of spacecraft, manned space laboratories, space experiments and expendable launch vehicles.

Mission Assurance Directorate Vision

A viable, effective leader as the safety, reliability, and quality assurance conscience at KSC with a clear voice in operational and decision-making processes.

Engineering Development Directorate Vision

To provide world-class facilities, systems, equipment, and laboratories and related services that meet or exceed our customer's requirements within cost and on schedule.

We communicate and reinforce our commitment to CI as a way of life through many avenue, as illustrated in Figure 1.1.a.1. Our executives communicate and reinforce organizational vision, quality values, and customer focus daily in staff and work requirement meetings with managers, supervisors, and employees. There are quality forums, written communications, speeches, all-employee meetings, brown-bag luncheons, and frequent visits to work sites with employees, customers, and suppliers.

KSC contractors, via a joint effort between their senior management and NASA senior management, carry the Center quality values message throughout their organizations as well. For example, Lockheed Martin senior managers operate as a steering team, meeting weekly to ensure program execution as well as promoting customer and employee satisfaction. An interlocking team structure is deployed from the top to the bottom of the organization, building a strong communication link down through the work force.

The NASA contractor organizations use written Award Fee Criteria to set direction and establish performance excellence goals for the Payloads Ground Operations Contract, the Base Operations Contract, and the Shuttle Processing Contract. Criteria definition is a coordinated effort between NASA and contractor management.

In addition, during career planning and performance planning, vision, values, and customer focus are stressed orally and in writing.

A focus on customers and CI are

incorporated into normal supervisory training programs. Team presentations covering these areas are reported to all employees in various KSC publications. Executives are also extensively involved in recognition sessions, along with supervisors and managers.

Reviewing Overall Organization Performance, Including Customer-Related and Operational Performance

After developing quality goals, KSC focused on developing operational improvement goals and reviewing progress toward meeting those goals. The KSC Strategic Plan objectives are actually the specific operational improvement goals. Each objective is assigned an owner, and each owner develops metrics related to the accomplishment of that objective.

Management reviews are conducted with the owners of each specific objective to gauge progress. To reinforce the importance of the strategic objectives, senior managers elected to base their performance plans on the various objectives for which they have ownership. These measures of progress, areas for improvement, and corresponding actions are discussed during regular reviews with Jay Honeycutt and the various directorates. Also, senior managers are evaluated in their midterm and annual performance reviews based on their performance in their strategic areas.

These continuous reviews illustrate the commitment and personal involvement of our management in this area. Sections 2, 3, 5, 6, and 7 illustrate processes in place to systematically collect and analyze data and make improvements in all areas of KSC.

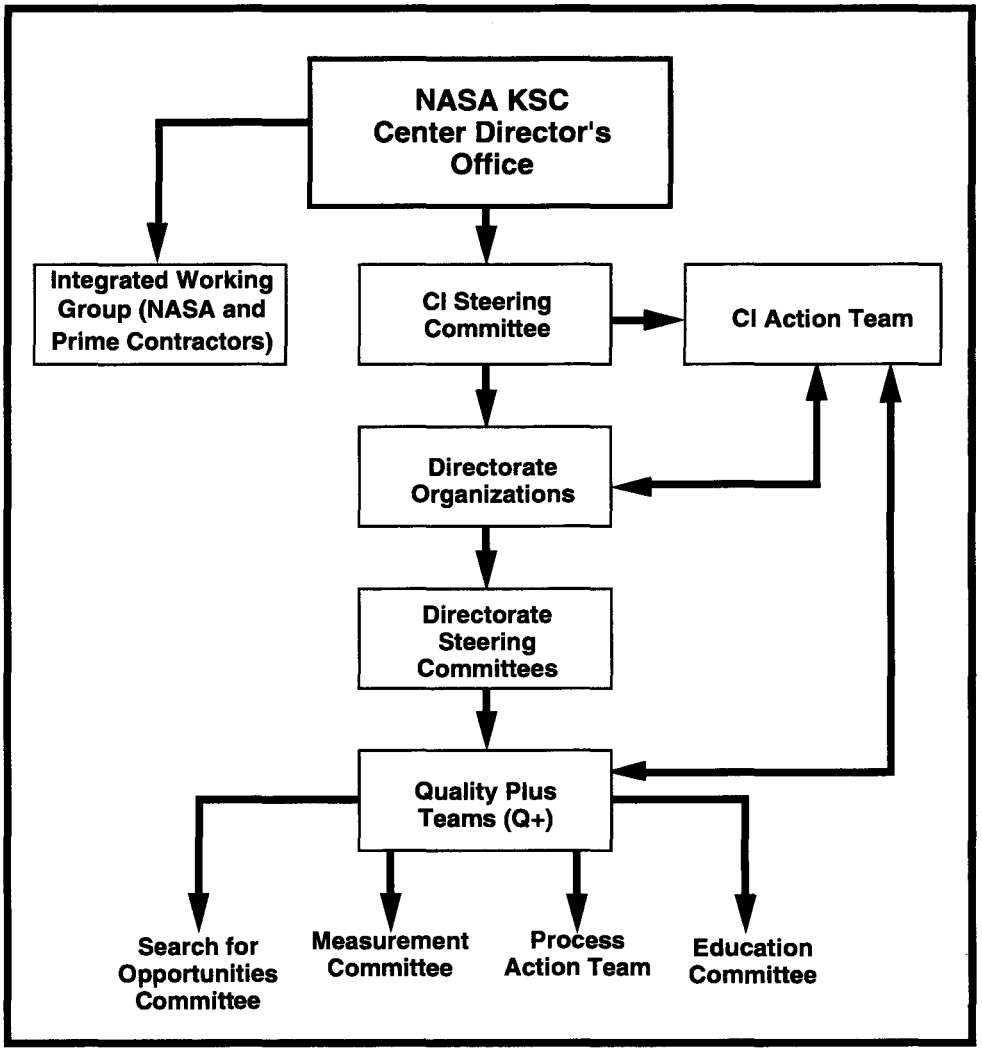


Figure 1.1.a.1 — KSC's organization and quality forums communicate and reinforce our vision, mission, values, and customer focus

Recognizing and rewarding employees who enable KSC to achieve improvement goals contributes to improved productivity, efficiency, economy, and effectiveness of KSC. We have comprehensive employee recognition activities that range from special daily efforts to end-of-year performance awards. Typical recognition awards include annual performance awards, special team ceremonies, time-off awards, employee of the month, letters and certificates of appreciation and commendation, On-the-Spot Awards, Space Flight Awareness, and Quality Assurance Superior Accomplishment recognition. These employee recognition programs are discussed in Section 4.

Both the CI Steering Committee and the Integrated Working Group create cooperation across functional and contractual lines to promote consistent quality management improvements. Line managers also provide guidance and assistance to Quality Plus (Q+) teams, which manage CI processes, including education and training, facilitating teams, developing measures, celebrating successes, and improvement opportunities.

The directorates' CI steering committees hold regular reviews for addressing issues that affect their organizations. As issues arise, man-

agers and supervisors have the opportunity to address them during the Steering Committee meetings, at Natural Work Team status briefings, or inμm

Center executive management reviews overall organization performance, including customer-related and operational performance. KSC's strategic objectives are translated into requirements for managers, supervisors, and employees in their respective performance plans.

We evaluate and improve our managers' and supervisors' effectiveness in CI through six-month reviews and annual evaluations.

1.1.b

Senior executives evaluate and improve the effectiveness of the organization's leadership system to pursue performance excellence goals. One way this is being accomplished is through a series of senior management training sessions that began in February 1995. Dr. Richard Huseman, Dean of the College of Business Administration at the University of Central Florida, presents seminars on "How to Meet the Challenge of Change," in which senior managers are evaluated on their adaptability to change. The seminar focuses on the reality and magnitude of change and the criticality of adaptability to change through continual improvement as reflected in the organization's leadership system.

All organizations describe specific critical job elements in performance plans to stress the importance of CI requirements in job performance; e.g., "lead, manage, and support the development and implementation of continual improvement initiatives."

Managers and supervisors receive informal and formal assessments of their effectiveness in reinforcing our vision, quality values, and customer focus in accordance with their performance appraisal plan discussions and ratings. All proposals for high-grade promotions and bonus awards are reviewed for support of key KSC areas of emphasis including the commitment to and fostering of CI.

For example, Payload managers are evaluated on maintaining a current customer/supplier inventory/feedback response system and metric/tracking system; implementing an effective communications system using CI tools; and delegating accountability, responsibility, and authority in all organizational activities. These managers, in turn, annually evaluate their subordinate supervisors on leading, managing, and supporting CI activities.

Procurement Office managers and supervisors are members of their organization's Steering Committee. Participation on the Steering Committee enables supervisors to measure the effectiveness of their set vision and values, allowing them to assess future direction and actions to move the CI process forward within the organization.

1.2. Leadership System and Organization

1.2.a

KSC's leadership system and structure are focused on customers and high-performance objectives. Our CI Plan exemplifies the way we operate. The plan designates management responsibilities for fostering CI, developing improvement objectives, collecting and using customer data, and empowering, rewarding and recognizing employees. It also spells out manager responsibilities for communicating and cooperating with other organizations and integrating between units.

Our managers and supervisors promote cooperation in our daily operations through close teamwork within and between all supporting organizational units. To maintain operational schedules, mission requirements, and safety, organizations have designated control points and team members for integrated work requirements. These employees serve as customer/supplier contact points.

"Launch Work is Teamwork" is more than a motto to the work force. The successful preparation and launch of the Space Shuttle and its payloads require that all civil service and contractor organizations work cooperatively on a daily basis. The KSC primary objectives are met through closely integrated team support.

KSC employees form partnerships with suppliers and customers and obtain a closer understanding of needs and expectations as illustrated in Figure 1.2.a.1. Employees meet daily with suppliers and customers, working together to identify problems as well as potential solutions. Employees participate with customers and suppliers in joint process improvement teams, customer focus groups, and lessons- learned forums.

In the Payload organization, customer surveys are used to target areas for improvement. The Payload customer is involved, meeting periodically with representatives of the resident offices to discuss customer ratings, listen to suggestions, and establish improvement initiatives.

In the Shuttle Processing organization, customer award fee criteria and high-performance are incorporated into the Steering Team's goals and objectives. The goals and objectives are flowed down the organization so that lower level teams can channel resources and focus on process improvements that meet performance expectations. In addition, Lockheed Martin has instituted the Task Team Leader program, which allows leadership to be practiced at all levels of the KSC work force. In this program, a team leader is assigned to all Shuttle processing tasks. The program provides clearly defined roles and responsibilities with emphasis on teamwork, cooperation, and common-sense decisions.

The Base Operations Contractor, EG&G, is in the process of implementing a strategic policy for which the goal is "to provide exceptional services and exemplary performance in responding to NASA's needs as established and defined by the Base Operations Contract." By embracing the Malcolm Baldrige National Quality Award core values as the foundation for continual performance improvement, EG&G senior managers are personally involved in the creation and assessment of CI strategies, and they provide stewardship of the structural planning and operating decisions that implement these strategies.

The union leadership of the American Federation of Government Employees, Local 2498, is involved and supportive of our CI initiatives and signed the 1994/1995 KSC CI Plan.

For external customers, organizations have designated individuals or groups to serve in interface functions. These individuals and groups

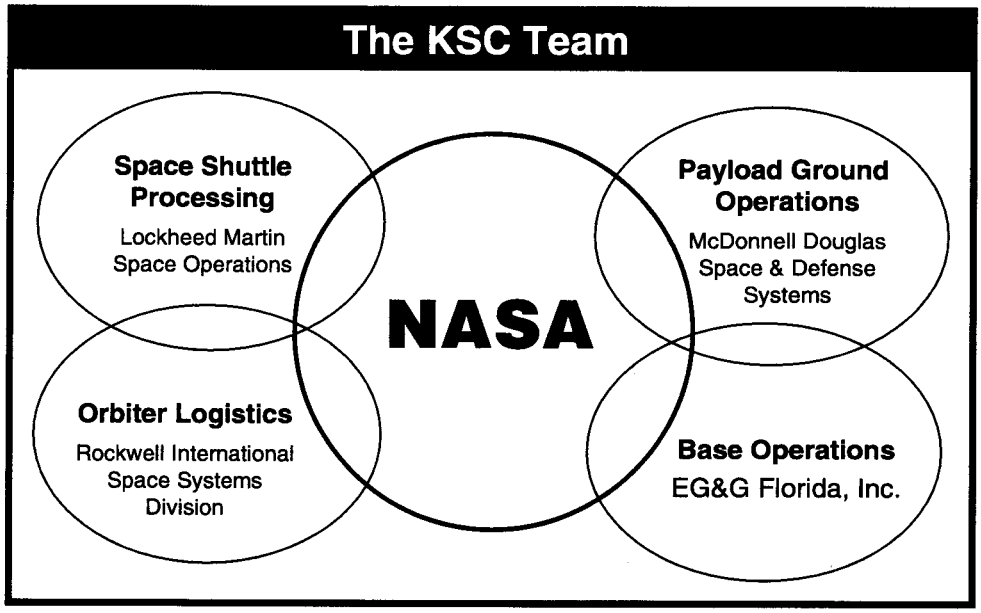


Figure 1.2.a.1 — The integrated KSC team effort

are given training and are empowered to respond directly to customer needs. On occasion, these key interfaces refer to technical authorities, call upon support throughout KSC, or coordinate team responses using the approach that best fits the circumstance. Standing committees, boards, and working groups with cross-directorate membership have been established and are empowered to act on a real-time basis to commit resources and resolve problems.

In some directorates, employees have been co-located or "partnered" with our contractors, suppliers, and, in many cases, our customers; and every day, we forecast, plan, implement, measure, communicate, reward, and improve as one team.

In Shuttle Operations, government, contractor, and payload customer representatives work together as part of each payload's mission-processing team. This team meets daily during processing and is responsible for planning and implementing payload activities throughout all phases of launch site processing. External organizations and suppliers participate on the team in resolving issues. Together, they work toward the common goal of safe and efficient payload processing.

The Space Station Program uses Integrated Product Teams (IPT's), which focus the efforts of a team on the design, development, production, operation, and support of a product end item. Members of the teams are from affected directorates and functional disciplines with a common task of acquiring equipment to support the International Space Station. This puts the responsibility of the end-item performance on the team and not their individual organizations. The Analysis and Integration Team (AIT) membership is composed of the leaders of each IPT. Cross-team integration is accomplished through interaction within an AIT. The IPT's have developed numerous key metrics that allow them to measure their processes and improve upon them. NASA Administrator, Dan Goldin, during a recent visit to KSC, praised the IPT's for their efforts in measuring and improving their processes.

The Procurement Office and our prime contractors have created the NASA-KSC Small and Disadvantaged Business Council. The Council's working group, composed of key executives, is empowered to enhance competition and socioeconomic programs.

The Safety and Mission Assurance Directorate partners with its customers to enhance operations and efficiency. For example, customers participated in a thorough team review of all Shuttle ground safety requirements to produce safety revisions understood and agreed to by all KSC organizations.

1.2.b

KSC values, expectations, and directions are effectively communicated and reinforced throughout the entire work force. The KSC Strategic and CI plans were distributed to all employees. Monthly and quarterly newsletters, all-employee meetings, exchange forums, and special events provide avenues to communicate and reinforce KSC's values, expectations, and strategic direction.

For example, the Space Center annually celebrates Quality Month. Last year's activities included letters from Bob Crippen to all employees, a reception for high-performing teams, a video link to the National Quality Forum, and videos on the NASA television channel emphasizing quality. Jay Honeycutt, Gene Thomas, and Al Parrish regularly visit with high-performing teams in the workplace to review team performance, to support their activities, and to publicize their accomplishments. Jay Honeycutt has expanded his personal role in these types of activities during his tenure. For example, he has initiated "Jay's Workday," in which he spends a day doing the job of another employee.

1.2.c

At KSC, organization and work unit performance is reviewed to improve performance. All major organizations present monthly progress reviews to senior Center management. All KSC organizations are represented at these sessions, allowing for an integrated review of metrics and group discussion of customer concerns. Organizations share lessons learned and accept action items to facilitate the reporting organization in meeting its objectives. Individual directors also obtain assistance from other directorates through informal channels.

We established contractor metrics to gauge the cost and organization performance of our primary contracts. Our contractors present metrics to the Center Director, reporting cost, schedule, technical matters, safety and mission assurance, subcontracting (socioeconomic), award fee, and continual improvement.

Individual directorates also conduct internal reviews. Payloads monitors organizational performance in quality and operational performance improvement plans through the Mission Processing Session (MPS). These sessions are conducted weekly to provide management with a detailed briefing of payload mission processing performance and planning status. Managers explain work accomplished, associated work force resources expended, and variances to the projected resource utilization. Managers then discuss work plans for the current and next week, together with associated resource usage projections. The MPS also provides a real-time forum to share lessons learned with NASA and contractor management. Lessons learned are reviewed, and actions are assigned, worked, and reported at subsequent MPS's, exemplifying another way in which our quality vision and customer orientation are fully integrated into our management system.

At KSC, we formally and informally assess our quality culture and the extent to which our vision, quality values, and customer focus have been adopted.

The results of a 1992 survey indicate that nonsupervisory employees recognize the positive role our managers are performing in CI. The survey reported employees had a high degree of awareness of the CI program. In order to track quality cultural changes, a follow-up survey is currently underway at the Center. Results of this survey will show to what extent senior managers have been able to maintain and improve their job in promoting CI as a standard way of doing business. The CI office uses focus group sessions to gauge the effectiveness and usefulness of training. Results of these sessions have also been used to provide insight to senior managers into what they can do to help foster CI at KSC.

Center management firmly believes external assessment should be used to improve local operations. As an example, last year KSC applied for and won the President's Quality Prototype Improvement Award.

1.3 Public Responsibility and Corporate Citizenship

1.3.a

Our public responsibilities are integrated into quality policies and

performance improvement practices through the KSC Strategic Plan, contractors' quality policies and plans, small and small disadvantaged business programs, and our daily quality improvement efforts.

Two goals captured in the 1995 Strategic Plan are (1) to protect, preserve, and enhance KSC's unique natural environment and (2) to foster increased external awareness, community involvement, and educational outreach. These two expressions of public responsibilities drive our operating plans and procedures, our energy and waste management policies, and our community outreach program.

Our public responsibility and community citizenship extend beyond the local community. We have a responsibility to ensure safe, efficient, successful operations for the American public and the international community. Jay Honeycutt has taken an active role interfacing with State Representatives and Congress, ensuring that KSC's effort to meet the Nation's goals are being communicated effectively.

In response to President Clinton's report, "Technology for America's Economic Growth, A New Direction to Build Strength," which states, "The nation urgently needs improved strategies for government/industry cooperation in the support of industrial technology," NASA Administrator Dan Goldin issued the NASA "Agenda for Change." He outlined a policy in which NASA would "pursue a commercial technology mission...that proactively involves the private sector from the onset...to ensure that the technology developed will have maximum commercial potential."

The 1995 KSC Strategic Plan emphasizes this mission as one of the primary Center goals. The Technology Programs and Commercialization Office is the focal point at KSC for achieving this goal (see table 1.3.a.1). The strong support of this effort began with former Center Director Bob Crippen and has continued with the current director, Jay Honeycutt. By using a cross-disciplinary team approach for identifying and prioritizing KSC research and development efforts and by aggressively pursuing a broad range of technology commercialization and cooperative industry assistance initiatives and university programs, KSC has been able to successfully respond to the President's increased emphasis for NASA research to be relevant to day-to-day activities of the American people.

The Installation Operations Directorate has strengthened efforts to conserve natural resources and assist local communities in reducing waste. The Center's recycling program has shown positive results and an increased sensitivity to the environmental concerns of today. Q+ teams are receiving opportunities for improvement that deal with improving the efficiency of recycling efforts and reducing paperwork. Since the inception of the program, nearly 8.8 million pounds of office white paper, computer paper, and cardboard have been collected. This amounts to saving a forest of nearly 75,000 trees and a reduction of landfill requirements by 25 percent. The recycled paper provides about $50,000 per year in revenue returned to the Government. KSC also has recycling programs for copper, aluminum, steel, batteries, tires, lumber, and fluorescent tubes. This is an indicator of our commitment to the environment and waste reduction efforts.

The Installation Operations Directorate, in cooperation with the United States Fish and Wildlife Service and the local community, maintains the productivity of 1,500 acres of citrus groves on KSC. This pro-

Table 1.3.a.1 — Technology Transfer Programs

Technology Outreach Program (Technology Transfer Agreement/ Space Act Agreement)	Florida businesses submit technical problems to the Southeast Regional Alliance	Transfer of benefits of NASA's unique technical expertise to industry within Southeast U.S.
Dual Use Program	Commercial partners involved in early development stage	Product meets both NASA and commercial needs
Spinoff Program	Commercial business using NASA-developed technology	Product redesigned to meet commercial needs
Tech Briefs	Published monthly	Alert industry of new NASA technology

duces approximately 22 full-time jobs and 300 seasonal jobs and contributes approximately $1 million to the local community and the U.S. Treasury.

As another major initiative, the Materials Science Division led an effort to develop an alternative cleaning process that eliminates the use of chlorofluorocarbon (CFC-113), which destroys the earth's protective layer of ozone and is considered to contribute to global warming. The integrated NASA and contractor team effort, involving multiple organizations, has shown significant progress toward the goal of totally eliminating the use of CFC-113 for precision cleaning at KSC.

To reduce water and energy consumption at KSC, we have implemented many new designs on our facilities. A joint NASA/Contractor team selected and designed the Water Treatment and Recycling System (WTRS) to recycle cooling tower water from the Shuttle launch pad support facilities, which enabled KSC to comply with current environmental requirements while conserving 3.54 million gallons of water annually. The WTRS is noteworthy because it conserves a precious natural resource, contributes to a cleaner environment, and reduces operating costs. Other energy conservation measures include fluorescent light replacement, motion light sensors, and more efficient heating/air conditioning systems. These have reduced the impact on the local resource base and have significantly reduced the consumption of electricity across the Center, saving money and reducing the pollution generated by the local power plant.

Operating the space program in a 140,000 acre wildlife refuge presents unique challenges. The Environmental Management Office leads KSC's efforts to minimize adverse impacts to this precious national resource. They are nationally recognized for their efforts in environmental permitting and programs, as exemplified by the winning of the 1994 "White House Closing the Circle Award" for hazardous waste minimization at KSC. KSC has also been recognized for their Manatee Release Program, which releases back to the wild Manatees that have recovered from injuries.

An example of KSC's public responsibility, the Disability Awareness and Action Working Group (DAAWG) was formed to enhance awareness of the capabilities of disabled people and to remove barriers that hinder disabled individuals from performing at their full potential. The DAAWG meets periodically with Jay Honeycutt and senior managers to discuss problems and assess progress towards their solutions.

In an effort to include employee families in the KSC mission, the senior management opens the Center for one day each year to employee families. Workers can tour their families through the facilities for an in-depth, up-close look at what they do for the space program every day. Several work areas offer hands-on displays that demonstrate basic concepts for design and test equipment. These have particularly high appeal to the children and young adults - the future of the program and the nation.

NASA-sponsored student programs and teacher workshops have been greatly enhanced by the opening of a world-class Center for Space Education at KSC. Built by the Astronauts Memorial Foundation through a cooperative agreement with NASA, this facility has greatly expanded NASA education programs while providing hands-on learning experiences for students of all ages. KSC operates more than 100 educational programs, most of these are overseen or supported by Public Affairs. A representative listing is summarized in Figure 1.3.a.1.

1.3.b

KSC maintains a presence in the community by encouraging its workers to lead and participate in community activities. Education outreach, newsletters, speeches, volunteer work, fund drives, and community management assistance are examples of how key community responsibilities are fulfilled. KSC employees serve in local county and municipal governments; on-boards of directors for colleges, hospitals, and other organizations; and as campaign chairmanships for charity drives. NASA and contractor employees are members of the Brevard Community Quality Council and serve on the board of directors and as members of various work teams, promoting quality activities in the community. KSC management believes that personal involvement in the community makes the difference.

KSC continues to have high participation in the annual Combined Federal Campaign. This year the program raised over $235,000 for the community, an average of more than $100 per person. KSC also had a 71-percent participation in the U.S. Savings Bond drive for 1995, which was the highest (by 21 percent) among all NASA centers.

A heavy emphasis is placed on education within the community; for example, an environmental newsletter that covers water quality, man-

Educator Programs	Student Programs
Film, Video, and Information Library	Aerospace Education Services
Educator Conferences and Tours	Summer Aides
Teacher Workshops	Stay-in-School
NASA's Education Workshop for Math and Science	Summer High School Apprenticeship Research
NASA's Education Workshop for Elementary School Teachers	NASA's Unique Resident Tutoring for Up-and-Coming Replacement Engineers
Summer Industrial Fellowship for Teachers	Science and Engineering Fairs
Vocational In-Service and Business Exchange Program	Career Shadowing
NASA/University Joint Venture	Early Childhood and Elementary Student; Space Life Sciences, Clerical, and Cooperative Training

Figure 1.3.a.1 — Public education initiatives

agement and control, air quality and control, and heavy metal safety issues - and more - was begun as a quarterly report; the newsletter quickly became a monthly publication available to all requesters. We also have made available to local emergency planners our optical database of over 14,000 material safety data sheets. We take an active role in the local educational system by encouraging engineers and scientists to discuss science and space exploration during visits to local classrooms. Jay Honeycutt has increased the emphasis on outreach programs to local schools. Last year, over 70 local schools received more than 2,100 pieces of computer equipment from KSC that were no longer useful to the government, but which provided solid foundations to establish or enhance laboratories for students.

Jay Honeycutt has also shown strong support for the annual "Day of Caring" sponsored by the Brevard County United Way. Participation in this program shows KSC's commitment to community involvement. Jay authorized up to four hours of administrative leave for employee participation during regular duty hours. Activities included: serving lunch to the homeless in the Brevard County Kitchen; assisting with homemaker chores for elderly, frail, or disabled adults; providing tutorial services and enrichment activities for preschool and elementary classes; and working one-on-one with "at risk" youth in elementary and high schools.

Further, we make information accessible to Internet users on a broad range of issues. The KSC's Home Page on the World Wide Web receives over 2,000,000 accesses per month at KSC. Also, each organization has formed partnerships with schools in the community, coordinated special programs, and provided assistance to help satisfy the needs of the students and teachers.

After Hurricane Andrew struck in south Florida, the KSC work force donated food, water, and construction materials. Volunteers, in cooperation with the Salvation Army, drove an eight-truck convoy to deliver the supplies to south Florida.

A Central Industry Assistance Office (CIAO) has been established offsite for easier access by firms interested in doing business at KSC. This facility is a central source of information for firms seeking business opportunities at the Space Center with NASA-KSC's procurement office and our prime contractors' procurement offices.

In summary, KSC senior management, including both NASA and contractor, has established and exceeded their personal commitment to KSC as a customer-focused organization devoted to Continual Improvement with quality-related activities embedded in its culture. By setting directions and performance goals and reviewing organization performance, the extensive involvement and high visibility of the top Center officials exemplify their Continual Improvement values and expectations.

2.0 INFORMATION AND ANALYSIS

Effective information and analysis systems are required to enable KSC to meet the challenges described in the organizational overview with the highest levels of quality, cost, and schedule performance ever achieved at KSC. The information and analysis systems also enable outstanding successes in continual improvement, as reflected in the positive results described in Section 6. In this section, we briefly describe how we manage data, turn data into information through analysis, gain additional information on best practices through competitive comparisons and benchmarking, and make decisions based on this information to get the results required by our customers. The elements of KSC's information and analysis systems are shown in Figure 2.1.

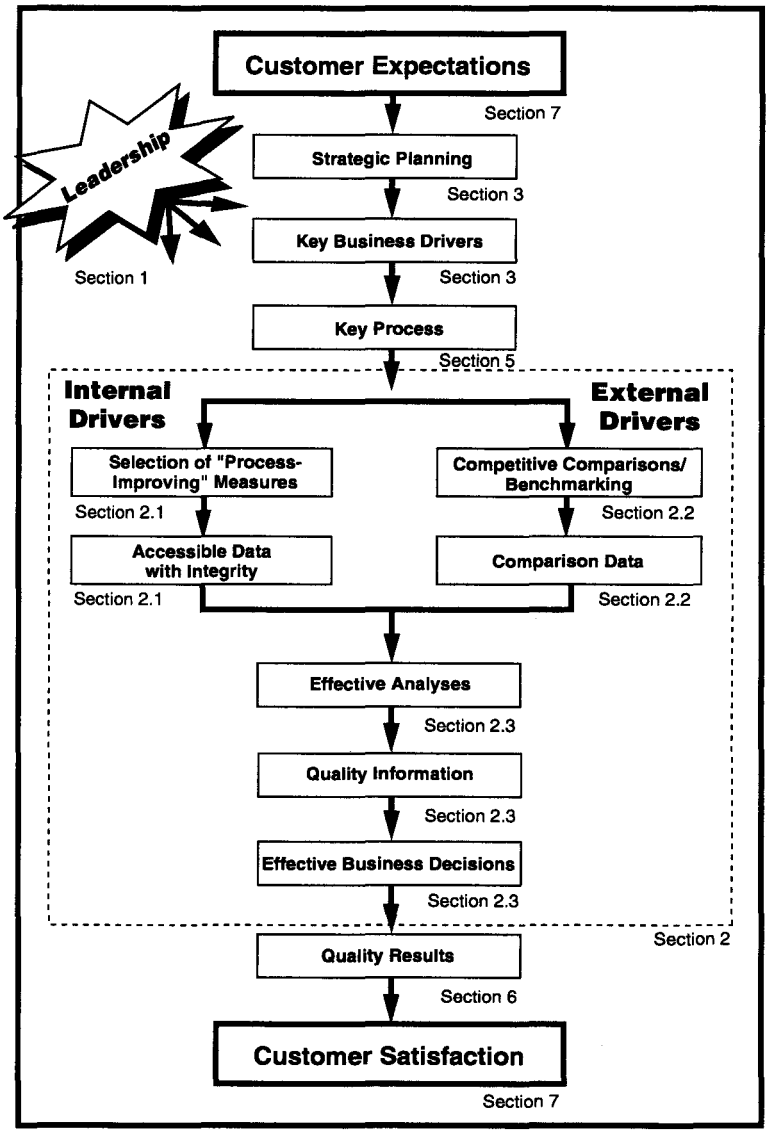


Figure 2.1 Elements of KSC Information and Analysis System

2.1 Management of Information and Data

This section describes how KSC selects and manages data used for planning, evaluating, and improving overall performance with respect to customer needs and expectations.

2.1.a

The KSC Strategic Plan guides the selection and development of our key processes and their respective performance measures. Section 3 details the KSC strategic planning process. The Strategic Plan divides the KSC mission into eight primary processes (tasks) and identifies strategic goals. The strategic goals determine the key business drivers and key processes that allow us to meet or exceed customer expectations.

To measure progress toward these goals, performance measures for each key process are established. The performance measures determine the data required to manage and continually improve key process performance. Performance measures are re-aligned and revised to reflect customer feedback, successfully implemented process improvements, and changes in the strategic goals.

The performance measures for each key process are divided into four main categories: customer satisfaction, quality (including safety), cycle time, and cost. Other measures cover key business drivers such as human resources, community service, environmental protection, technology transfer, cultural diversity, and public affairs. Examples of data sources used at all levels of the organization to improve overall performance are listed in Table 2.1.a.1. Many of the specific measurements using these data sources are displayed in the charts throughout Section 6.

Several criteria determine the data used for improving perfor-

Table 2.1.a.1 — A sample of KSC measures

Types of Data/ Measures	Sample Data Sources/Systems
***Quality** - General*	• Problem Reports per Mission • Open Paper Reports • Quality Surveillance Report • In-Flight Anomaly Report • Payloads Error Rate • Combined Supplier Survey Database • Supplier Performance • Quality Surveys
***Quality** - Safety*	• Incident/Mishap Frequency • Occupational/Mishap Injury/Illness Rate • Payload Lessons Learned Database
Cycle Time	• Shuttle & Payload Processing Schedule Meas. • On-time Vendor Payments • Travel Voucher Processing Time • Procurement Review Time
Cost	• Labor Hours per Mission (Shuttle & Payload) • Technician Time per Task • Cost per Flight • Contractor Budget Performance
Customer Satisfaction	• Payload Customer Survey Database • Supply Effectiveness Database • Public Affairs Survey
***Other** - Environmental*	• Hazardous Waste Database • Quarterly Facility Waste Site Discrepancies • Volume of Waste Reduction • Chemical Management Error Rate • Environmental Noncompliance • Geographic Information System Data • Energy Consumption/Savings
***Other** - Employee Development*	• Training Database • Development Programs • Employee Surveys
***Other** - Employee Involvement*	• Search For Opportunity Report • Employee Surveys • Team Participation • Team Presentations and Awards
***Other** - Diversity*	• Equal Employment Opportunity Reports • Small Disadvantaged Business Reports • Kennedy Multicultural Leadership Training

mance. For example, the data must: (1) be effective in measuring desired performance and in forecasting results, (2) provide information to identify problems and corrective actions, and (3) be economical to collect. A KSC Measurement Handbook and Workbook was developed to assist process owners in planning and establishing their performance measurement programs.

Figure 2.1.a.1 summarizes how KSC selects data that, after appropriate analyses, supports decision-makers with information directly relevant to the KSC strategic goals.

Our overall approach for ensuring reliability, consistency, validity, and ready access of data is increased use of automation, computer networks, and common computer databases.

For example, KSC employees use electronic mail to communicate and to send/receive data files. Several data systems give users the flexibility to customize analyses and online reporting of data they retrieve. Work and administrative procedures may also be accessed online. Automated tracking systems provide timely data on work location, in-work status, and estimated completion dates. User requirements are also driving the expansion of KSC Internet capabilities.

Many different methods are used to provide data with integrity in our information and analysis systems. We define data integrity to include data accuracy, consistency, reliability, validity, and completeness. All data systems employ appropriate electronic security measures. Work documents, part inventory tags, and warehouse locations are bar-coded to enhance traceability, reduce data entry errors, and improve data timeliness. Several databases employ automatic data entry edit checking.

Classes are available for training users to properly fill out data entry forms and to use new computer systems. A computer-based tutorial explaining the importance of data integrity and how shop floor data fits into the continuous improvement cycle is available to Shuttle processing employees in their work areas over a local area network.

2.1.b

KSC established an early standard for effective information and analysis systems with the Launch Processing System, which has sup-

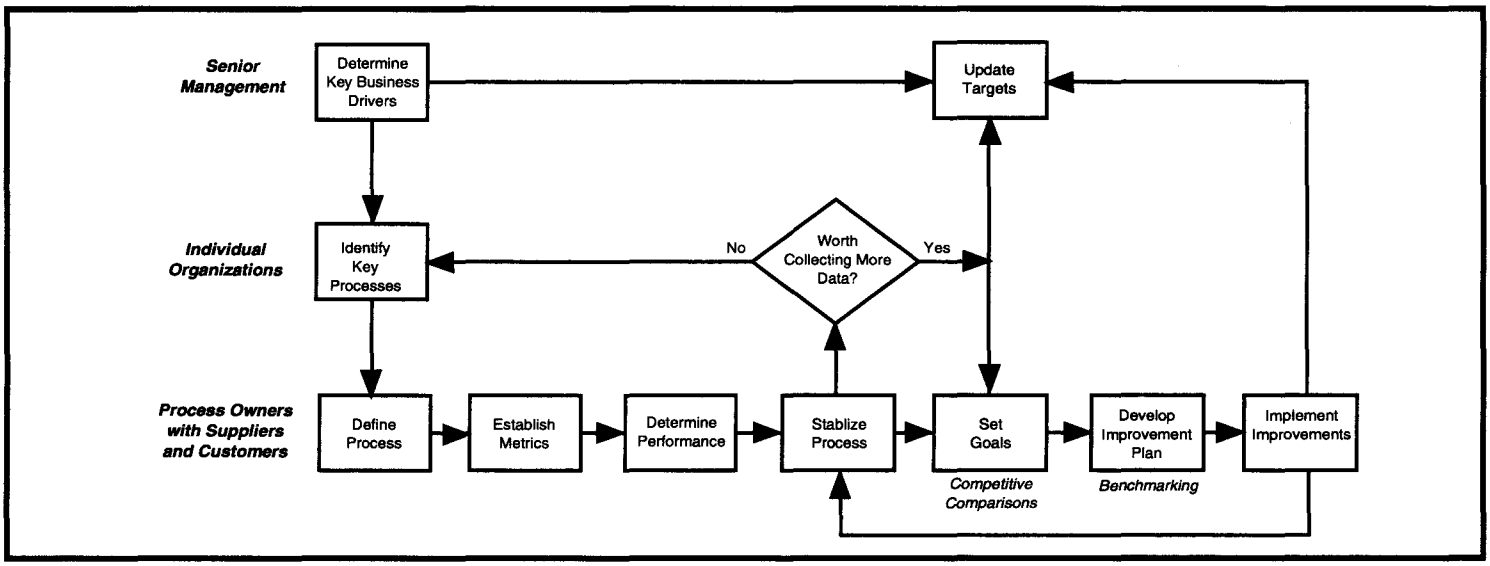


Figure 2.1.a.1 — KSC data selection process

ported our most critical process – flight hardware test/checkout and launch operations – since the Apollo era. The Launch Processing System routinely collects enormous amounts of reliable data, analyzes that data, and makes it rapidly available to users. This system was designed to meet the extraordinary demands of its users, the launch team. The tremendous launch success KSC has achieved over its history is, in part, attributable to this extremely effective information and analysis system. The basic design approach of the Launch Processing System was adopted by KSC managers as information and analysis systems in other areas were refined through the use of computer systems.

All KSC organizations develop their own key quality and performance indicators to allow them to identify areas needing improvement. KSC managers use various methods to align and integrate data analyses with the key business drivers. The award fee criteria and areas of emphasis help identify specific key business drivers for each six-month period, allowing managers to focus their improvement efforts. NASA and contractor functional reviews allow management to monitor progress and make necessary adjustments to achieve program success.

We evaluate and improve methods for the selection of data through our analysis results and through feedback from customers, users, and process improvement teams. For example, the payload customer survey questions are updated annually based on customer feedback. The award fee evaluation report provides valuable feedback from NASA to its contractors. This report details contractor strengths and areas for improvement. Process improvement teams are chartered by management to determine root causes of substandard process performance and to make recommendations for corrective actions.

2.2 Competitive Comparisons and Benchmarking

KSC comparative studies cover the full range of the benchmarking spectrum. In general, informal and/or internal benchmarking studies, which have been a "way of life" at KSC for many years, are setting the stage for more formal external benchmarking efforts. We are also developing partnerships and innovative techniques to make formal external benchmarking efforts more cost-effective for KSC. We will, however, continue to perform different types of comparative studies to meet varying user needs. This section describes the KSC efforts to build a sustainable process for benchmarking and competitive comparisons of key processes.

2.2.a

Competitive comparisons and benchmarking studies are performed in most functional areas of KSC. Examples of informal and formal benchmarking efforts are listed in Table 2.2.a.1. An external study refers to a study with partners outside KSC, while an internal study refers to a comparison of processes between various organizations or facilities within KSC. It should be noted that several of our internal studies would qualify as external studies in organizations less diverse than KSC. For example, the benchmarking study for government property man-

Tabel 2.2.a.1 Examples of KSC Benchmarking Studies

Examples of KSC Benchmarking Studies

Process/Study	Partners	Type of Study	Scope of Study	Results
Government Property Management	KSC Benchmarking Network Members	Formal	Internal	Reduced Costs, Cycle Time, and Improved Quality
Facility Maintenance	NASA Centers & Industry	Formal	External	Reduced Cost
Software Development	Software Engineering Institute	Formal	External *(with independent org.)*	Reduced Cycle Time
Facility Reliability-Centered Maintenance	NASA Centers and Industry	Formal	External *(with independent org.)*	Results In Work
Standard Wear	Depot-Level Maintenance Organizations	Formal	External	Results In Work
Welding	Shuttle Processing Facilities	Formal	Internal	Results In Work
Ground Support Equipment Scheduling	Shuttle Processing Facilities	Formal	Internal	Study In Work
Case Tracking and Management	Selected Law Firms	Informal	External	Results In Work
Launch Processing	China, Russia, Japan, Arianespace	Informal	External	Data for Strategic Planning
Orbiter Processing Performance	Different KSC Facilities Shuttle Missions	Informal	Internal	Reduced Cost and Cycle Time, Improved Quality
Special Material Inventory and Tracking System	DoD and Industry	Informal	External	Approved Control and Accountability
Areas of Excellence Study	Shuttle Processing Facilities and Groups	Informal	Internal	Improved Quality

agement is internal to KSC but involves seven different contractor organizations.

The specific results of each study vary depending on the process studied, the number of process improvements implemented, and how long the improvements have been in place. For example, the complete results of the government property management benchmarking study are not yet available, but early indications are that cost savings will be significant. Within two months of the distribution of findings to process owners, three organizations reported a combined cost avoidance of over $41,000. A fourth organization reported a 57-percent reduction in cycle time for Property Loss, Damaged, or Destroyed (PLDD) reports, and a fifth organization reduced the number of PLDD reports by 84 percent.

The key processes and performance measures identified through the KSC strategic planning process also form the foundation of our comparative study efforts. In general, the amount of resources we invest in a benchmarking study is directly proportional to the level of potential payback. This relationship is illustrated in Figure 2.2.a.1. Additional criteria for selection of processes for benchmarking studies include process criticality, process stability, availability of documentation, and cost of implementing process changes.

Internal benchmarks are regularly identified within KSC's diverse organizations and facilities by analyzing and comparing the internal performance measurements discussed in Section 2.1.a. For example, the number of technician work-hours per processing flow are routinely compared between the three orbiter processing facilities. These internal comparisons have directly contributed to the results in Section 6, such as the reduction in processing costs and the reduction in the average number of labor hours per work authorizing document.

In addition, process owners are encouraged to constantly be aware of developments outside KSC through informal networks, technical and business literature, and performance evaluation by internal NASA/government audits and external independent organizations, such as the Software Engineering Institute for the assessment of software development processes.

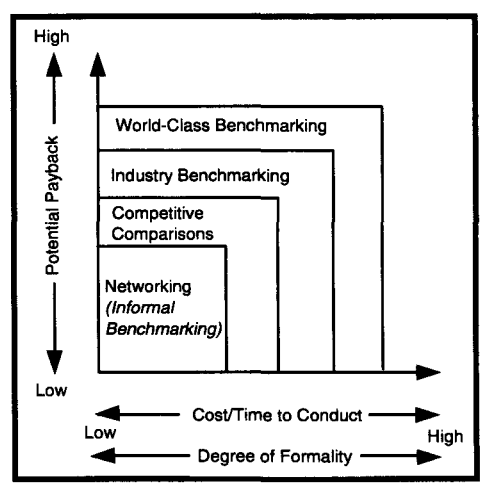


Figure 2.2.a.1 – How KSC selects from different types of comparative studies

2.2.b

KSC continues to refine its benchmarking methodologies based on customer feedback and requirements, the availability of new techniques, and evaluation of improvements and lessons learned from previous benchmarking studies. The result is several innovative benchmarking efforts that place KSC on NASA's "cutting edge" of comparative study techniques.

For example, the NASA Facilities Maintenance Benchmarking Group meets monthly, via the NASA video conferencing system, with representatives from NASA centers and industry. During the video conferences, the team's approaches are constantly updated. The video conferencing system is a KSC institutional capability, so this benchmarking effort itself contributes to our strategic goal to "better utilize KSC's institutional capabilities."

The KSC Benchmarking Network, a collaboration of NASA and nine major KSC contractor organizations, has pioneered and customized consortium benchmarking techniques to enable more cost-effective benchmarking studies. A sample of a gap analysis tool used by the KSC Benchmarking Network is illustrated in Figure 2.2.b.1. The methodology of the KSC Benchmarking Network was tested with a pathfinder study of government property management which has already resulted in the cost savings described in Section 2.2.a.

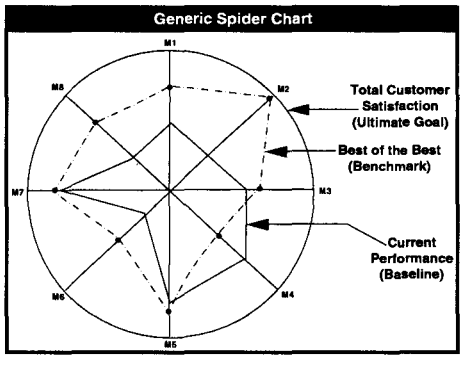


Figure 2.2.b.1 – Example Gap Analysis Technique used by the KSC Benchmarking Network

The efforts of the KSC Benchmarking Network Team have been recognized both inside and outside NASA. At the 1995 NASA Continual Improvement and Reinvention Conference, NASA Administrator Dan Goldin presented an award recognizing the team's "outstanding contribution to NASA quality management and the continual improvement philosophy." The Network is also a recipient of a prestigious 1995 Benchmarking Award from the International Benchmarking Clearinghouse.

The Center Director's Discretionary Funds were used to sponsor benchmarking research at a local university. The purpose of the research was to advance the state of the art in benchmarking technology by applying existing benchmarking techniques to Shuttle processing activities and customizing those techniques as required. The results of this research will be entered for a 1996 International Benchmarking Clearinghouse award.

KSC has undertaken efforts to standardize the structure and improve the effectiveness of formal benchmarking studies. One method is increased benchmarking training from the American Productivity and Quality Center. To date, over 100 employees from all major KSC organizations have been trained. A second method is the adoption of a NASA-wide benchmarking policy to produce more consistent benchmarking results throughout the agency as well as within KSC.

Benchmarking studies are also being refined with external inputs, such as feedback from the 1995 President's Quality Award and Florida's Sterling Award applications. The information from the feedback reports has already been incorporated into the KSC benchmarking strategy.

Perhaps the best indicator of the success and maturity of KSC benchmarking programs is that other organizations are now visiting KSC to search for best practices. For example, other NASA centers are studying KSC's benchmarking processes, external industries are studying KSC's safety practices, Texas Instruments is performing a comparative analysis of customer satisfaction with our payload processing organization, and Commonwealth Edison has studied our facility modification/management processes.

2.3 Analysis and Use of Organization-Level Data

We perform effective analyses of internal and external data to provide quality information to decision-makers at all levels of KSC. The impact of our effective use of organization-level data on KSC's strategic goals is obvious. As demonstrated in Section 6, we have continually improved efficiency and customer satisfaction over the past several years without adversely affecting mission success.

The types of analyses performed on organization-level data are driven by user requirements and the types of data collected. Pareto, trend, cause-and-effect correlation, statistical process control, and root-cause analysis techniques are used extensively for organization-level data. Correlation between related performance measures also verifies vari-

ous analysis results. KSC has the capability to perform more sophisticated analyses when required by the users. Examples of advanced analysis techniques include process simulation modeling (recently used to analyze specific orbiter spares processes), decision modeling, and probabilistic risk assessment.

2.3.a

The organization-level review, action, and planning process includes data and information gained through the internal measurements described in Section 2.1 and the comparative studies described in Section 2.2. All data and information is synthesized during several reviews and analyses. For example, quality, schedule, and customer data are aggregated in the manifest/flight planning cycle, the "readiness" reviews, and the payload lessons learned process.

During the manifest/flight planning cycle, payload-unique customer requirements are combined with standard Shuttle requirements and nonstandard work to resolve open problems, develop the schedule, and develop work plans. Customer feedback on additional processing time requirements is incorporated. This cycle includes reviews of prior as-planned/as-run schedules to highlight areas needing improvement.

At our readiness reviews, quality metrics and overall performance data are presented for NASA management and payload customer review. The readiness reviews are major milestones during the preparation of each Shuttle mission, and they provide an excellent mechanism for KSC to openly communicate with its primary customers. The typical readiness review cycle is shown in Figure 2.3.a.1.

During the payload lessons learned process, inputs from customer surveys, quality and safety data, and operational performance are reviewed to determine both problem areas and internal best practices. This process is described in additional detail in Section 7.

2.3.b

Organization-level data reviews involve a combination of measures (cost, cycle time, quality, customer satisfaction, and others). All measures are tied to key business drivers and overall customer satisfaction. For example, the readiness reviews emphasize schedule performance and technical issues. Quality inspection trend data is reported at monthly intervals to KSC management. Negative trends result in actions to identify root causes and corrective actions such as procedural changes, design changes, and process changes.

One key method we use to integrate financial and nonfinancial data is the Associate Administrator Review Status (AARS) process. The AARS process is an organization-level review of data relating KSC's key health indicators (specifically in cost, schedule, and technical performance) to budgetary compliance and customer satisfaction. The AARS review includes discussions pertaining to all completed milestones and communicates any impact on KSC's progress to plan against its designated budget. The AARS also helps determine the budget estimate through fiscal year completion and its associated impact on the rest of NASA.

In addition to the AARS process, quality, operational, safety, socioeconomic, and award fee data are integrated with financial data and reviewed through the Contractor Metrics Report. This report provides timely data to the Comptroller and all levels of KSC management. These reporting processes enable KSC management to quickly resolve financial and nonfinancial issues and to identify areas needing improvement.

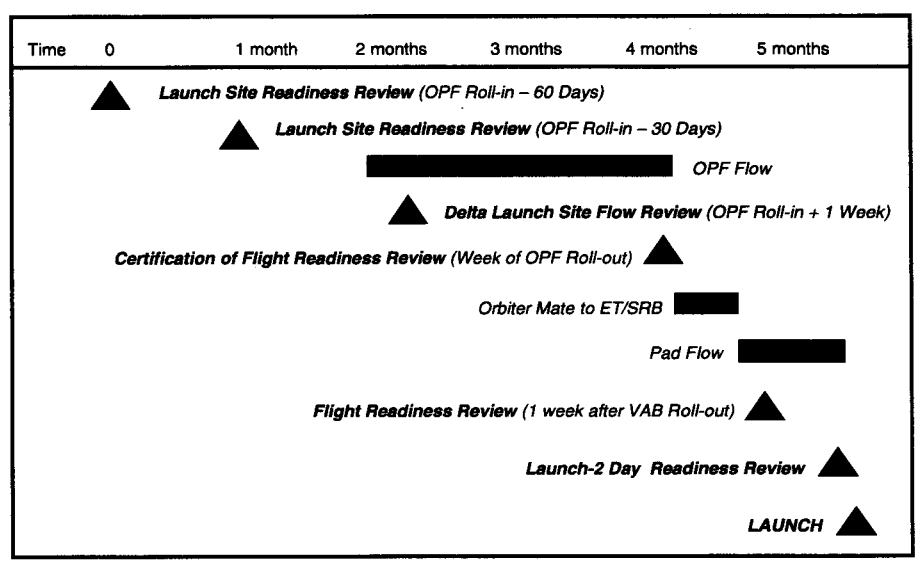


Figure 2.3.a.1 — Typical Readiness Review Cycle.

3.0 STRATEGIC PLANNING

3.1 Strategy Development

3.1.a

KSC's strategic planning process is structured to generate a management tool for use in forecasting trends, analyzing customer and supplier considerations, implementing strategies, and allocating resources. The basic process model is depicted in Figure 3.1.a.1. The product of the process is a practical and specific plan that contains achievable, measurable goals, and a good accompanying implementation plan showing not only the goals but the road map to determine whether the goals are being achieved.

Since 1993, representatives appointed from each functional area have convened annually to review and recommend revisions to KSC's Strategic Plan in accordance with our mission statement, vision, and goals. These representatives come from diverse backgrounds and specialties to provide a broad perspective on the team's planning effort. Each team member serves as a focal communication source for plan input from civil servants and contractors from all levels within their functional areas, as well as their customers and suppliers. The team's purpose is to recommend changes to the Strategic Plan that enable the Center to better plan and prepare for activities, impacts, or changes in the Center's future.

The 1995 plan drew from five basic sources to identify potential activities, impacts, or changes. First, documents such as the NASA Agency and Space Flight strategic plans were analyzed. These plans drive overarching requirements down to the Center. Second, interviews were conducted with first-line directors using specific questions to determine potential activities, impacts, or changes for KSC's future. Third, interviews were conducted with the chief executive of the three major KSC contractors. Fourth, the KSC government union was interviewed with similar questions. Fifth, a periodical search, encompassing more than 50 articles written over the previous nine months, was conducted for external trends and indicators. From this effort, approximately 75 areas were identified for review to ensure adequate coverage in the KSC plan and consistency with the agency documents. The team members met periodically with management to provide status and for additional management input. During the 1995 review, the team agreed that the forces influencing KSC had not changed drastically to warrant a major rewrite and recommended only a revision.

The KSC Strategic Plan encompasses short- and long-range goals. Short-range goals are scheduled to be met in one to two years; long-range goals are five- to ten-year efforts. The plan considers (1) customer/supplier requirements, (2) work process changes from CI efforts, and (3) our unique role in the nation's civilian space effort.

Once the goals are established, directorates assume primary responsibility for each of the major goals. To reinforce the ownership, specific goals are included in senior management performance plans, and flow down the organization into individual performance plans. The directorates identify individuals and teams to work specific elements within the plan. This approach has yielded an employee-owned plan with leadership for specific elements at both supervisory and nonsupervisory levels. The improved ownership of the plan strengthens the operational effectiveness from individual work units, through the directorates to the overall Center. The refinement of the goals reflects our increased commitment to the CI journey.

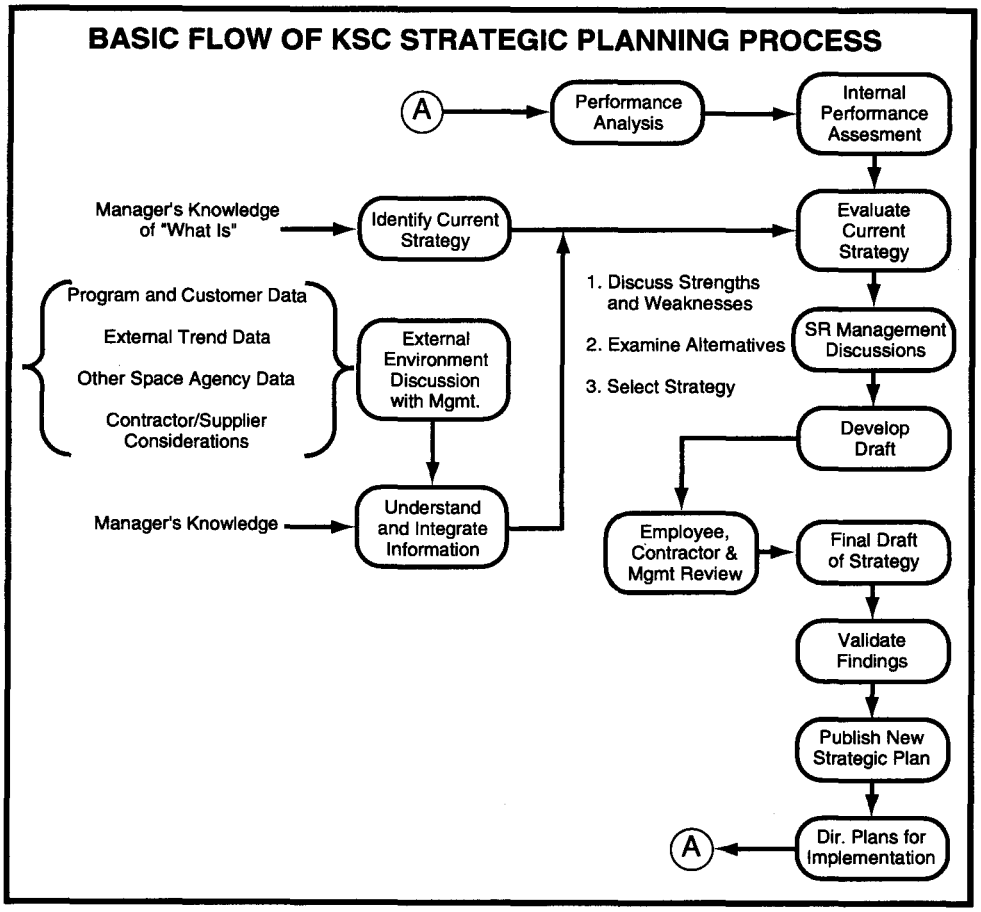
With specific goals established for KSC, processes are identified that directly relate to each goal and the desired results. An implementation matrix is used to identify these processes, assign owners, and establish timelines. CI provides the methodology to achieve the schedule targets, and customer satisfaction is the basis for key measures used to track progress.

Strategic planning at KSC entails effecting a balance between the internal focus of processing and launch activities and the external challenges from just-in-time budget allocations to metric conversion, from technology transfer to total resource management. The goals identified in the planning document are expected to be valid even as the Center transitions to a prime contractor, with reduced NASA involvement. This operational change encompasses customer expectations that physical, personnel, and monetary resources be better utilized and prepares us for a new partnership with our contractor team (See Table 3.1.a.1).

3.1.b

Once the KSC Strategic Plan is published, the plan is distributed to each employee and widely distrib-

Table 3.1.a.1



uted to our contractor partners and suppliers. Senior management meets to (1) review the goals, (2) validate specific ownership, (3) determine resource requirements, and (4) resolve risk-related issues. Business plans such as the Program Operating Plan are reviewed and aligned as required. Each directorate then revises its internal strategic plan and internal operating plans to detail the implementation of the goals and objectives. Flow down organizational plans are developed in line with the Strategic Plan. Teams are formed within the directorate to develop a comprehensive ownership and measurement matrix down to the natural work group level.

Jim Jennings, the Director of the Administration Office, coordinates Center strategic performance measurements and owners' strategic objectives for Centerwide reporting. His organization also coordinates and facilitates CI performance in the areas of measurement, team building, planning, and the formal improvement system.

Our partners and suppliers subsequently assess and realign their plans with the revised KSC Strategic Plan. This synchronization optimizes our efforts to achieve our goals and helps ensure an efficient use of resources.

A primary goal in the 1995 Strategic Plan is to provide safe and efficient payload preparations and launch and landing services while reducing costs Centerwide. One effort initiated in 1995 was the consolidation of KSC's logistics operations from multiple contractors and multiple directorates to a single directorate and, ultimately, to a single contractor. The consolidation effort requires partnering between contractors to allow a single contractor to perform logistics functions efficiently and at a substantial cost savings. The processes developed from this consolidation should help KSC become the Logistics Center of Excellence for the Agency.

Another goal with significant impact to the Center is the improvement of institutional processes. Key drivers include productivity and resource management. A specific objective targeted reducing barriers in the acquisition process. Procurement teams have recently utilized parallel negotiations with contractors and now disclose weaknesses to each competitor in their proposals. This open disclosure has resulted in a unique partnership due to a major change from the long-standing philosophy that better products and services could be negotiated with an adversarial approach.

3.1.c

The strategic planning process evolved from an executive management effort to establish an empowered team representing all work levels within their directorates. Originally, the goals were separately documented in the Strategic Plan, while the methodology for achieving them was documented in the Continual Improvement Plan. KSC has recognized that these "what" and "how" plans need to be brought even closer together and consolidated into one document; the 1996 Strategic Planning team is chartered to accomplish this effort.

Each team that performs the annual planning cycle meets with se-

nior managers and previous team members to review the lessons learned on the process. The process is then modified to fit current conditions. The 1996 Strategic Planning team will be managing the process with increased emphasis on external drivers to the plan. NASA as an agency has dramatically shifted its philosophy on manned space flight within the nation's political climate. KSC is planning a transition to government ownership, and contractor operation of our facilities and launch systems. This change will drive increased customer input into the planning effort as well as supplier/partner input for successful implementation.

For the 1996 plan, information-gathering sessions are expected to be held with key players on the appropriate NASA Strategic Enterprises KSC will support. Interviews are also anticipated with key players at KSC and within NASA on the changing roles of KSC civil servants as well as expected relationships with contractors and other NASA personnel. This information should help develop areas of emphasis for the 1996 plan. Transition planning for organizational change and human resource utilization, performance contract monitoring, and process improvement are some of the areas expected to be stressed in the 1996 plan.

Measures tracked with each organization are consolidated in the Administration Office and reviewed by the Center Director. Each organization conducts an assessment in meeting those objectives and the adequacy of their deployment. Adjustments to their processes are made based on internal assessment and feedback from the Administration Office and from the Center Director.

Table 3.2.a.1 - Relationship Table

KSC Strategic Goals	Key Drivers	Representative Key Requirement	Performance Indicator	Directorate Owner/Resources Committed	Potential Benchmarks
Goal 1: Provide safe and efficient payload operations and launch services while reducing Centerwide costs.	Safety, productivity, cost.	Perform Shuttle processing at or below operating plan budget.	Reduced Shuttle processing cost for eight flights per year.	Shuttle Operations.	Airlines and other Space Agencies.
	Strategic alliance.	Perform payload processing at or below budget while maintaining payload customer satisfaction.	Reduced payload processing cost and increased customer satisfaction.	Payload Operations.	Handling Operations.
	Safety.	Reduce the number of operational mishaps and processing incidents.	Reduced processing and operational mishaps.	Safety and Mission Assurance.	Airlines and other Space Agencies.
Goal 2: Maintain and enhance a highly skilled, culturally diverse,motivated team.	Resource management, productivity.	Increase team efforts to improve products and services across organizational lines.	Increase in product and services improvements implemented.	Administration Office.	Organizations that have experienced major downsizing.
Goal 3: Improve and better utilize KSC's institutional capabilities and processes.	Productivity.	Identify and pursue initiatives to eliminate internal KSC and Agency barriers to the acquisition process.	Reduction in procurement lead time and reduction in paperwork.	Procurement Office.	Other Federal Agencies Procurement Offices.
Goal 4: Use KSC expertise to develop, implement and transfer new technology.	Technology transfer.	Increase partnerships with outside KSC organizations to enhance technology transfer.	Increase in number of partnerships with outside organizations.	Engineering Development.	Other Federal Agencies, Bell Laboratory.
Goal 5: Protect, preserve and enhance KSC's unique natural environment.	Resource management.	Reduce incidents of environmental noncompliance.	Hazardous waste minimization.	Installation Operations.	Chemical manufacturers.
Goal 6: Foster increased external awareness, community involvement and educational outreach.	Education.	Increase educational outreach.	Increase in employee participation in community programs.	Public Affairs Office.	Major corporations.

3.2 Strategy Deployment

3.2.a

Key business drivers include traditional industrial requirements for hardware processing and service activities, such as productivity, safety, and quality. Additionally, technology transfer and resource management (property, personnel, and monetary) are critical to our success. The key drivers are reflected in the six major goals within the Strategic Plan. Table 3.2.a.1 highlights the goals, related drivers, representative key performance requirements, associated measures, and directorate owners. These owners are responsible for implementation as discussed in 3.1.a. The table also provides benchmark activities related to 3.2.b.

3.2.b

A projection of key measures and indicators is provided in Table 3.2.b.1. The indicators have been distilled from previous analyses to a more meaningful select set. The projections reflect adjustments based on previous forecast versus actual data.

Table 3.2.b.1 - Multiyear indicators for other Cost Improvements

PROJECTED % CHANGE IN PERFORMANCE FROM FY92 BASELINE		
PERFORMANCE INDICATOR	**FY96 PROJ.**	**FY97 PROJ.**
Reduced Shuttle Processing Cost	-29.1	-29.9
Reduced Payload Processing Cost	-32.5	-32.0
Reduced Processing and Operational Mishaps	-15.0	-15.0
Increase in Product and Services Improvements Implemented	5.0	5.0
Reduce/Eliminate Acquisition Process Barriers	20.0	5.0
Increase in Number of Partnerships with Outside Organizations	20.0	20.0
Hazardous Waste Minimization	-5	-5
Increase Employee Participation in Community Programs	15.0	15.0

4.0 HUMAN RESOURCE DEVELOPMENT AND MANAGEMENT

Preparing for the Future

Change has been a hallmark of KSC from the first manned launches of the Mercury, through Apollo, and into the development and operation of the Space Shuttle program of today. Now comes a much more drastic change; one from NASA playing a leading role in the launch process to one of contractors assuming more of the responsibility. This will result in an anticipated reduction in the civil service work force of around 50 percent within the next 4 to 5 years. While this change is expected to reduce costs and make the launch process more efficient, the transition is one of great uncertainty and concern for all KSC employees.

A key objective of our Human Resources program is to provide ways to maintain and enhance productivity during these difficult times. We have taken the attitude that quality management is also important for difficult times, even more so for periods when external pressures and concerns are greater.

Our most important asset is our employees who are valued for their individual skills, contributions, professionalism, and dedication to our mission. We empower our employees to broaden their knowledge and experience and promote CI. In keeping with our Strategic Plan objectives, we have recruited a culturally diverse work force and provided a work environment that encourages career growth and rewards and recognizes employees for quality performance.

Table 4.1.a.1 — Key Human Resource objectives

1. Provide training and career development opportunities for all employees.
2. Develop a systematic program within each organization to embrace the concept of growth in individual responsibility and ownership of work and to support a positive environment of continuous improvement.
3. Develop a systematic program within each organization to identify and transfer unique skills and knowledge to the next generation of discipline specialists and managers.
4. Encourage people to "rotate" between job assignments.
5. Recruit high-potential applicants from all available sources in order to achieve a highly skilled diverse work force at all functional and management levels.
6. Continue to educate the work force on the benefits of cultural diversity in order to promote a positive environment for all.
7. Ensure performance plans are job related and clearly defined and contain specific measurements.
8. Recognize and reward employees for quality performance.
9. Increase employee participation in team projects and empower them to implement efficiencies, economies, and improved services within and across organizational lines.
10. Review current roles and functions to develop alternatives for changes in the way work is performed at KSC.
11. Improve internal communications at every level so all people are well informed of opportunities and commitments.

4.1 Human Resources Planning and Evaluation

4.1.a

Human Resources planning and evaluation are considered key elements of our short- and long-range planning program at KSC. One key goal of our Strategic Plan is to maintain and enhance a highly skilled, culturally diverse, motivated team. To achieve this goal, 11 specific objectives are outlined in the plan, providing direction for the Human Resources Strategic Plan (see Table 4.1.a.1).

However, since the Strategic Plan was developed, a number of actions have been initiated to cause a change in our short-term planning. These changes have created the challenge of how to ensure that work force productivity and well-being remain at a high level while facing major structural changes and severe reductions in the employee population.

For example, in the near-term, we are emphasizing objective 11 and,

in light of severe hiring limitations, have reduced emphasis on objective 5. We are looking for ways of increasing voluntary separation of employees in order to lessen the impact of a possible major reduction in force. Instead of recruiting, we are stressing outplacement assistance efforts to ensure that we not only help to find acceptable alternative employment but preserve the gains we have made in establishing a culturally diverse work force.

The Personnel Office initiated a Career Transition Assistance Program in April 1995 to assist employees during the transition period. The program is conducted through a private contractor and provides employment counseling, job search, and resume preparation services. Since its inception, approximately 700 employees have utilized this service. An onsite Career Fair was held for KSC employees with more than 20 companies sending representatives. NASA installations not affected by a major work-force reduction also participated. The Personnel Office established an E-mail "hotline" in addition to a telephone "hotline" to respond to employee questions and concerns about the transition to the privatization of KSC.

We ensure our employees have the opportunity to update their knowledge and skills through a broad range of training and education programs. Our education and training strategy is developed from an annual analysis of employee training needs. The education and development of our employees is considered a vital element in our operational strategy and policy. This is keyed to the Individual Development Plan, through which employees are empowered to plan their own career decisions for education, training, developmental assignments, and long-range career goals. We have a strong career development process designed to enhance and sustain a highly skilled and motivated work force.

Work-force diversity and mobility goals and issues are addressed through recruitment, rotational assignments, and diversity awareness training. Due to our recent hiring limitations, our recruitment efforts have been redirected with a high priority given to expanding the representation of women, minorities, and individuals with disabilities. Prior to the hiring freeze implemented this year, our recruitment extended to feeder programs, including cooperative education, stay-in-school, undergraduate and graduate programs, and summer fellowships for high school and college faculty.

The percentage of minorities and women in high grade positions has doubled over the past five years. In August 1995, women and minorities held 22 percent of the high grade positions. During a ten-year period, the grade level for women increased 36 percent and minorities increased 20 percent. Even though the Center population has increased only 6 percent since 1985, the percentage of minority employees increased 113 percent and the percentage of women employees increased 104 percent.

Organization restructuring and workforce redesign are accomplished by empowered employees who have demonstrated an interest in supporting the development of new organizational structures through the use of Red and Blue Teams. These organizational structures, created by the employees, have encouraged performance at higher levels, motivated the employees, and reduced the supervisor-to-employee ratio. This process is further discussed in Section 4.2.

Our reward and recognition program covers a wide range of events, from our Annual KSC Honor Awards Ceremony and formal organization recognition ceremonies, to informal gatherings where employee and team achievements are recognized. Organizations at the lowest level have been encouraged to reward employee and team performance. Management fully supports the development of new awards and ceremonies to recognize employees and reward excellence.

The performance management and feedback element of the Human Resources Strategic Plan ties into the broader KSC Strategic and CI Plans and the performance plans in each organization.

Our policy is to maintain the highest quality performance at the lowest cost without compromising the performance criteria of safety, timeliness, and efficiency. CI performance elements are in place in the position descriptions of the Center Director and senior executives, and cascaded down through manager and supervisory levels into all employee position descriptions.

As a part of our Human Resource planning, KSC has taken the lead in NASA and in the Southeast in the formation of a labor-management partnership council with AFGE Local 2498. This action was initiated in 1994, beginning with training provided by the Federal Mediation and Conciliation Service. In late October, a Partnership Council Charter was approved with a notification to all employees from the Center Director. The Council meets monthly to dis-

cuss management and employee issues. KSC representatives were invited to speak at the National Partnership Council's meeting in Atlanta, Georgia, in June 1995.

4.1.b

We use data collected from management and employees to improve the development and effectiveness of our work force, operations, and practices and to support our processes. Improvement in our practices is tracked by employee and customer surveys such as the Continual Improvement Survey, the Cultural Barrier Identification Survey, and other feedback methods such as the Center Director's Information Exchange Forum, focus groups, town meetings, and open forums.

We improve our operations and processes by including employees, customers, suppliers, and union members on cross-functional teams and in the Team Coordinators Quality Council activities.

As a result of the Peoples Initiative Task Team, dual-career ladder positions have been established to recognize and retain talented employees who contribute to the accomplishment of our mission by remaining in nonmanagement technical positions.

To achieve one of the key objectives of the Human Resources Strategic Plan, management created a Rotational Program, where select employees are given the opportunity to develop and learn about operations in different organizations. Work force mobility and diversity is also stressed by encouraging employees to "rotate" between job assignments within and outside of their organization.

4.2 High-Performance Work Systems

4.2.a

Employees contribute to promoting high performance and meeting operational goals and plans through a number of processes and practices. One method is an organizational culture with a mission-focused management philosophy that promotes excellence in day-to-day operations.

Our culture has historically been focused on a KSC team concept. Employees understand and demonstrate the team concept in their day-to-day relationships with customers and suppliers. Employee participation is promoted by team activities in process improvement, cross-functional, government, contractor, red and blue reorganization, strategic and CI planning teams.

A second method of involvement is through Action and Q+ teams which are in place in our major organizations. Employee Involvement Team or Natural Work Group members have also received training to perform the Q+ team functions in the smaller organizations. Most organizations have used cross-functional teams in their process improvement efforts.

4.2.b

As stated above, employee involvement is encouraged through the overall culture of a team concept at KSC. Civil service employees at KSC work directly with their contractor counterparts or suppliers to consider issues and processes and to conduct other day-to-day activities. Also, we utilize a number of different team concepts to maintain, encourage, and improve employee participation. The latest and most pervasive of these are the IPT's/AIT's previously discussed.

Employee opportunity for increased involvement in the Procurement office comes in the form of a collocated work force, both logistically and organizationally. This permits a direct and immediate interface with the internal customer and promotes the ability to respond quickly to the changing needs of the customer. Further, Contracting Officer authorization is issued at the lowest possible level, enabling the lower level journeyman to make decisions within their authority.

Cooperation between NASA and contractors in the formation of teams is further evidenced by the KSC Teams Coordinator Council, chaired by NASA and composed of team coordinators from 12 of our major contractor organizations. A KSC Civil Service and Contractor Teams Reception is held annually in October to recognize the contribution of the teams and team members.

Methods of evaluating the effectiveness and extent of employee involvement include team presentations at meetings of the KSC Integrated Working Group and Steering Committee, formal and informal visits by management to the worksite, focus groups, town meetings, written and oral communications, surveys, and the Search for Opportunities (SFO) process for recognizing individuals and teams. Senior executives, steering committees, and Q+ team leaders also promote employee and team involvement throughout KSC.

More importantly, we track team results, some of which are reflected in Table 4.2.b.1.

Table 4.2.b.1

TEAM RESULTS		
Name	**Activity**	**Improvement**
Environmental Permit Application Team	Decrease cycle time	Cycle time decreased from 149 days to 86 days
Construction Submittal Team	Decrease construction submittals	Deleted 30% of construction submittals
Financial Management Team	Reduce cost of preparing Financial Management Form 533	Saved $71,467 in printing and review time

With clearly established goals, training, and empowerment, all interested employees are able to participate in CI team activities. Management clearly supports the team concept as employees perform their jobs and make improvements. A CI culture survey conducted in October 1992 indicated that approximately 73 percent of our employees agreed their immediate supervisor was supportive of the CI program. Nearly 65 percent of the employees responded that they had an interest in playing an active role in the CI process.

A Systems Advisory Panel, established by the Comptroller in 1987, meets regularly with employees to exchange information and provide guidance on information technology issues and problems. The integrated Space Transportation Accounting and Resources System Migration Team, consisting of 50 members, was a major contributor to the successful migration of financial and resource management systems. Team members received a Group Achievement Award in recognition of their timely and highly beneficial system automation.

The SFO system managed by empowered employees, permits employees and teams to introduce and implement improvement ideas easier and faster, taking ownership of the process, and making improvements. Improvements are judged on timeliness, practicality, and benefit to KSC.

SFO's received are categorized according to the process: operational, administrative, or quality of life. A large number of SFO's have been received and many have produced significant results. The SFO system was implemented by KSC as a NASA pilot program and has now been accepted by our employees as the way of doing business.

NASA and contractor employees participate on quality improvement and problem-solving teams. NASA employee involvement on integrated teams continues to increase, as reflected in Table 4.2.b.2.

Our processes for recognition, promotion, compensation, reward, and feedback all support CI quality and performance objectives and are designed to provide recognition for exemplary accomplishments in improving efficiency and effectiveness and to provide positive reinforcement to individuals and teams. Our contractors, customers and suppliers are also given feedback through our recognition and award program.

Supervisors are encouraged to provide timely feedback through informal performance reviews throughout the year and then evaluate and rate employees on an annual basis against specific job elements, work goals, and performance standards that apply to each employee's position. These standards are ultimately tied to the KSC Strategic and CI Plans. Employees receiving monetary awards for performance will also receive the newly created Performance Award certificate.

Individual directorates and offices have also developed methods to encourage and recognize employee contributions. Employees in the Chief Counsel's Office received prestigious medals in recognition of their support of teams. In the Comptrollers Office, teams are recognized monthly for their contributions. The Procurement Office celebrates the success of team and individual accomplishments with its employee showcase bulletin board. Other organizations have celebrated with picnics, formal meetings, and other informal gatherings in recognition of employee contributions.

Table 4.2.b.2 — Overall Team Involvement increases

Teams	**7/90**	**7/91**	**7/92**	**7/93**	**7/94**	**7/95**
NASA	9	32	90	95	38	44
Contractor	122	412	571	793	832	846
Integrated	11	88	114	114	152	138
Total	142	532	775	1002	1022	1028

Several unique awards are given by the Safety and Mission Assurance Directorate to NASA and contractor employees. These provide recognition and reward to employees, customers, and suppliers across the spectrum of organizations at KSC. KSC has been designated the lead center for the development and presentation of the Quality Assurance Special Achievement Recognition Award. A second award given under the Safety Initiatives Award Program is designed to recognize contractors for improvement to their safety programs. All contractors are eligible to participate in this voluntary noncompetitive program. Goals, indicators of success, and the method of measurement are negotiated up front. If the contractor implements all initiatives and can show that the goals have been met, they receive an award. Another award is the Quality Assurance Certificate of Appreciation recognizing excellence in the workplace.

As a result of an employee survey conducted in 1991, Deputy Director, Gene Thomas, established an On-the-Spot award and increased the awards budget for nonsupervisory personnel. This award is for contributions recognized in the work unit as being above and beyond the normal work requirement. Any employee may nominate another employee for the award. Important aspects of this award include peer recognition and an immediate payback. Another innovative method of recognizing and rewarding employees is the Time Off Award, an award which grants the employee time off from work up to 40 hours per year.

Recognition programs are held in each organization throughout the year to recognize and honor teams and individuals for performance, leadership, meritorious accomplishment, exceptional achievement, productivity improvement, and service.

In addition, KSC holds an Annual Honor Awards Ceremony where agency awards such as the NASA Distinguished Service Medal, Outstanding Leadership Medal, Exceptional Achievement Medal, and Exceptional Service Medal, KSC Directors Award, Equal Opportunity Award, Secretary of the Year, Points of Light, Woman of the Year, and Public Service Medal may be presented.

At the most recent KSC Annual Honor Awards Ceremony held in April 1995, 15 teams and more than 150 NASA and contractor employees were honored for their contributions to the achievement of KSC goals and objectives. Over the previous four years, 56 teams and more than 500 individual employees have been recognized and honored at this ceremony. Three senior executives, JoAnn Morgan, Bob Lang, and Bob Crippen, received the Presidential Meritorious Executive Rank Award. This award is limited to only 5 percent of the Senior Executive Service work force. Twelve other KSC executives have been presented this award over the past five years.

Performance of KSC employees contributing specifically to our quality goals may also be recognized through letters of appreciation, certificates, plaques, newspaper articles, and ceremonies.

Our employees say that recognition events such as luncheons, picnics, and celebration at informal office gatherings are an effective way to recognize individual and team accomplishments. In addition, some organizations have developed and present mementos of various kinds to recognize employee contributions. Organizations have been urged to be creative in their approaches; for example, the Procurement office hands out light bulbs for good ideas and the Comptroller gives employees a silver or gold swan.

4.3 Employee Education, Training, and Development

4.3.a

Management has determined that quality education and training will be provided by linking training decisions to operational strategy and policy. Training plays a fundamental role in achieving our goal of developing a high-quality work force, where employees have been empowered to make their own career decisions. The employee and supervisor jointly layout the Individual Development Plan used in the appraisal and career development process.

We use a variety of approaches to provide education and training to our employees. Training priorities are recommended by senior managers who are responsible for strategic planning decisions in the operating organizations. Training needs are then developed from the employee requests and organization surveys of needs. The survey data is folded into the Annual Training Plan that balances need against budget and identifies courses available to the work force.

Many of our training courses are attended by a mix of managers, supervisors, and employees, which tends to significantly strengthen communication, foster an appreciation of CI issues and concerns, and reinforce the benefits of teamwork. Educational programs and presenta-

tion methods used include: classroom training, lectures, case studies, seminars/symposia, on-the-job training, rotational assignments, and partnerships with local colleges and universities. Significant improvement has been made in the training opportunities available as evidenced by an increased number of course offerings and an increase in the number of employees attending.

The following examples are taken from a long list of CI training courses available to our employees: Benchmarking, Tools and Techniques for Benchmarking, Organizing and Managing Benchmarking, Customer Service, Defining Work Processes, Facilitator Training, Process Analysis, Process Improvement and Problem Solving, Process Mapping, Teambuilding, and Basic Measurement.

Other courses available that relate to meeting our goals and furthering the CI effort include: Cultural Diversity in the Work Force, Ethics Training, Prevention of Sexual Harassment-Employee Awareness, Disability Awareness, Handling Violence in the Workplace, Stress Management, Myers-Briggs Type Indicators, Managing Change, Procurement Integrity, The Human Element, and Crossing Departmental Lines.

This year a two day Multicultural Leadership Program was introduced with KSC employees trained to serve as leaders and facilitators in the training sessions. Approximately 700 employees have attended this course as of August.

NASA senior executives and their contractor or supplier counterparts, have received training in the Continual Process Improvement Boot Camp program. This program was considered so beneficial that NASA obtained a site license for training and now has facilitators available to provide Just-In-Time training. Since April 1994, nine teams have been trained to work on specific processes selected by the CI Steering Committee.

A Technical Leadership Program was instituted in September 1990 to provide mid-level lead engineers and scientists the fundamentals of leadership and teambuilding in the context of participatory management. More than 400 employees have completed this training.

Since the Residential Management Education Program began in 1983, 388 middle managers have attended a one-week offsite program focusing on developmental exercises and panel discussions with senior executives to reinforce their work direction and values. A segment on the CI process and use of measurements has been incorporated into the program.

A Master of Science in Engineering Management Program provides employees with many of the tools used in the CI process, including Probability and Statistics, Operations Research, and TQM. In response to a recent survey, a Master of Business Administration Program was introduced in January 1995 and provides the same benefits to our employees as the Engineering Program. The advantages are that classes are offered onsite, particularly during work hours, and opportunities are available to network with other employees through the extensive use of group projects and presentations.

4.3.b

One of the key methods and indicators used to evaluate the effectiveness of training is that employees evaluate the course and instructor at the conclusion of each course. The instructor presents the attendee with an evaluation form, which is returned to the Human Resources Development office for analysis. If the course content or presentation is not satisfactory, the instructor is notified so that appropriate modifications or corrections can be made. A recent measurement course, presented on an introductory trial basis, was later modified to provide a more appropriate level of content for the individuals attending.

Feedback is also obtained from the supplier, the individual, the organization involved, and focal groups. At KSC, we have implemented the NASA Training and Development System to track training information.

There has been an increasing effort to provide exposure to the value and concepts inherent in quality training to senior executives, that began with a three-day conference in 1990. A two-day action workshop to determine the culture at KSC and set the direction for CI was conducted later with all senior executives in attendance.

Emphasis was placed on TQM training at KSC when the Cumberland Group was selected to present TQM/CI training to management and employees in July 1991. An Executive Workshop was held for senior executives followed by workshops for managers and supervisors, thus cascading the training down into the organization. During this introduction period, a four-hour Employee Awareness class was conducted for all employees. Additional sessions were given for new employees and for those previously unable to attend.

Table 4.3.b.1 — KSC has invested almost $1 million in CI training over the past five years

Fiscal Year	All KSC Training Annual Dollars in Thousands	TQM/CI Training Annual Dollars in Thousands
1990	$1,436	$60
1991	$1,995	$350
1992	$2,004	$193
1993	$2,157	$210
1994	$2,845	$162

A two-day Productivity Improvement and Quality Enhancement Seminar that focuses on integrating team activities, training in quality management, customer service, and the value of employee participation has been shared with contractor personnel regularly since 1987.

Table 4.3.b.1 shows the funding authorized for training and the dollars spent on TQM/CI training at KSC. The TQM/CI training peaked in 1991, which is attributed to the extensive quality awareness startup training.

The participation of KSC employees in TQM/CI training has continued to increase over the past five years, which is an indicator of employee interest in the program. Table 4.3.b.2 reflects the trend.

4.4 Employee Well-Being and Satisfaction

4.4.a

Safety, health, and satisfaction are particularly challenged during times of stress and uncertainty. KSC has long been committed to the concept of Safety First. It is a part of a our culture that was profoundly affected by the Challenger accident in 1986.

Our Environmental Management Office is responsible for Centerwide integration of regulations to protect our employees and the environment from hazardous products. This office developed an electronic information system identifying asbestos at the Center. As all asbestos has not been removed, continual studies for its presence as well as those identifying hazardous waste, ground water contamination, air quality, storm water control, and industrial waste water containment are carried out. In addition, there are frequent studies and reviews of endangered species and wetlands.

4.4.b

The well-being and satisfaction of employees requires a holistic view of services and options offered. In this general area, KSC provides fitness and health care centers that are open to accommodate all work shifts. Our health programs provide a smoke-free environment, employee health clinics, an aerobic program, and an exercise trail. The programs' goals are to maintain the mental and physical well-being of the work force, decrease sick leave, and increase alertness, morale and self-esteem. Important wellness programs, including dietary counseling; cancer, diabetes, and cardiovascular screening; smoking cessation counseling; and other conferences, seminars, and activities are conducted throughout the year to promote a healthy lifestyle.

The Center provides ergonomic assessments of worksites to assure appropriate working conditions and to recommend intervention to eliminate or minimize potential problems, including repetitive motion injuries. Additionally, the Center is in the process of introducing a number of intervention training courses to help eliminate on-the-job-injuries.

We have a flexible work schedule to help employees balance their professional and personal requirements and support the Center's role in its commitment to public health, safety, employee assistance programs, and ethical conduct. Emphasis has been placed on family-friendly options, as well as having recently instituted the flexible-hour work schedule called flextime to help balance professional and personal

Table 4.3.b.2 — Dollars, hours of CI training and average number of courses per employee

Fiscal Year	1990	1991	1992	1993	1994
Dollars	$164.21	$207.88	$136.67	$362.92	$854.24
Hours	6.19	10.47	12.45	24.76	26.32
No. of Courses	1.0	1.1	1.4	1.3	1.5

demands. Nearly 30 percent of the work force is now on flextime. A leave transfer program has been available for several years, and a onsite child care facility was recently opened for dependents of KSC employees.

The Federal Women's program at KSC has conducted monthly wellness seminars that are open to all Federal employees. We have provided mammogram screening as part of the standard employee physicals for some time and, in 1995, installed privacy screen areas in all major facilities for new mothers.

A key factor in ensuring employee well-being and satisfaction lies in the ability to communicate the availability of employee services, options, requirements, and major events in a successful manner. In that respect, we made a major commitment to upgrade our personnel communications. In 1995, a major change in the KSC personnel newsletter was made by increasing publication from one or two times per year to a monthly publication and making a drastic change in the style of presentation. Three reader surveys have been conducted, the last survey having about a 33 percent response rate. Less than 2 percent of the respondents felt the newsletter did not cover areas of importance, was untimely, or not readable. The U.S. Office of Personnel Management (OPM) conducted a Human Resources Assessment Visit during May 1995 and recommended the personnel newsletter for possible inclusion in OPM's Digest of Exemplary Practices.

In addition, the Personnel Office began a series of minibriefings, covering a variety of subjects. Briefings are conducted each week and address such topics as leave, the Federal Employee Retirement System, the Civil Service Retirement System, life and health insurance, reduction in force, and other family-friendly resources.

In 1994, the Personnel Office reorganized to provide better service. In its assessment review, the OPM found this change had "a profound effect on the way the Personnel Office is perceived." The assessment review found that about 90 percent of managers and supervisors agreed that the Personnel Office provided overall high-quality service, provided timely and efficient service, treated customers courteously, and provided a wide scope of personnel services. More than two-thirds of the nonsupervisory employees were equally positive in their responses.

4.4.c

Employee well-being and satisfaction are tied to the goals and objectives stated in our KSC Strategic and CI Plans and those in the Human Resources Plan addressing quality improvement activities. Safety programs at KSC encompass both prevention and detection efforts and include occupational safety and hazard detection, annual and random safety inspections, and enforcement of unique operational safety requirements.

In the evaluation of employee well-being and satisfaction, we have several traditional measurements of turnover, worker compensation, grievances, safety incidents, absenteeism, abnormal patterns of leave usage, safety, grievances, corrective actions, and worker compensation claims, which are tracked by various organizations. Other factors considered are the effects of retirements, resignations, and transfers. Employee satisfaction is determined through employee surveys, or one-on-one meetings between the supervisor and employees. One indicator of satisfaction is our low employee turnover rate. Our turnover of regular, full-time employees for the last five years has been about 1 percent.

Three recent surveys provided information on various aspects of employee satisfaction and well-being. They were the NASA Agencywide Employee and Customer Satisfaction Survey, the OPM Personnel Services Customer Survey, and the OPM Human Resources Management Assessment Visit. We note that of the 15 measures of Human Resources Services, NASA and KSC exceeded the government average on all of the measures. KSC exceeded the NASA average on 13 of the 15 measures, and was within the top three NASA centers on 10 of the measures.

Many new initiatives have been instituted to increase the overall effectiveness of safety and health programs for employees. Efforts have been undertaken to make our programs proactive rather than reactive. We have established and maintained an environment in which our CI atmosphere and processes contribute to work force excellence through employee motivation, personal development, empowerment, and employee pride.

A Merit System Protection Board survey conducted last year, entitled Working for America, found that 72 percent of the Federal employees were satisfied with their jobs. NASA employees were the happiest, with a satisfaction level of 81 percent.

5.0 PROCESS MANAGEMENT

Process management has been an extremely important part of the spaceflight program since its inception. During the Mercury, Gemini, and Apollo programs, we focused our efforts on refining our processes to provide the highest quality processing of flight hardware to ensure the safety of the flight crews and the highest probability of mission success. Between the first Shuttle flight and STS-25, our emphasis was to decrease processing cycle time. After the Challenger accident, we had to change our emphasis. We "re-invented" our processes to improve operational safety. Since then, we have concentrated on improving efficiency to allow us to meet our current budget reduction goals without compromising safety.

5.1 Design and Introduction of Products and Services

5.1.a

Meeting or exceeding customer requirements is one of the basic principles upon which the space program was built. It is our legacy. For our current external customers, such as the Shuttle Program Office or the principal investigators for the payloads we process, we have developed very rigorous processes to define and track processing requirements developed jointly with the Program Office and other NASA centers. Our configuration management processes ensure every requirement is satisfied prior to flight. In addition, we work closely with our customers on a daily basis to communicate progress and to discuss intermediate problems.

For our internal customer-supplier relationships, we have developed processes by which we jointly develop schedules for Shuttle and payload processing. We also hold daily centerwide meetings with all supporting organizations to ensure that any changes in the schedules are coordinated with all suppliers involved and that each can meet its obligations. We interface with customers to ensure that products and services are designed to meet customer requirements, working through integrated teams, joint meetings and reviews, formal agreements, and operational schedules.

In order to ensure that our products and services meet or exceed our customers' requirements, we emphasize customer coordination and integration in the design of any new hardware and services using techniques such as concurrent engineering and integrated process improvement teams with the customers.

We have updated the Paging and Area Warning System, a mission-critical system used for voice announcements and personnel warnings. The system was initially installed at Launch Complex 39 for the Apollo program and the number of facilities had stretched beyond the capacity of the original system. The design engineering team worked with the Shuttle Operations customers to refine the system expansion requirements. Together they developed a plan to reuse equipment and optimize the design, thereby saving money and reducing logistics requirements. Because the customer was involved in every step of the development process, the customer received a system that met or exceeded all requirements.

Another example of how we design services is our new management structure in the Space Station support organization. This was discussed in Section 1.2.a.

5.1.b

We design and introduce new products through concurrent engineering and other practices that stress customer involvement. Whether we are developing new facilities or equipment to support hardware processing or developing data systems or support processes, we strive to improve operational efficiency with user-friendly products.

Teams typically consist of a lead project engineer, the design engineering team, customers, and all other appropriate organizations. At design reviews, customer input is solicited and incorporated into the design. Customer satisfaction is then tracked through metrics provided on the project status report sheets. Our customers are viewed as members of the design team whose contributions are so critical that the project cannot be successfully completed without their active involvement and support (Figure 5.1.b.1.).

As an example, in design engineering, new or upgraded facilities and support equipment are designed and introduced to meet or exceed customer requirements by first identifying critical customer needs, including the customers in the design evaluation process, jointly certifying the product for use, and tracking customer satisfaction. Teams are formed to solicit customer requirements, generate a solution that is a best method to obtain required functions,

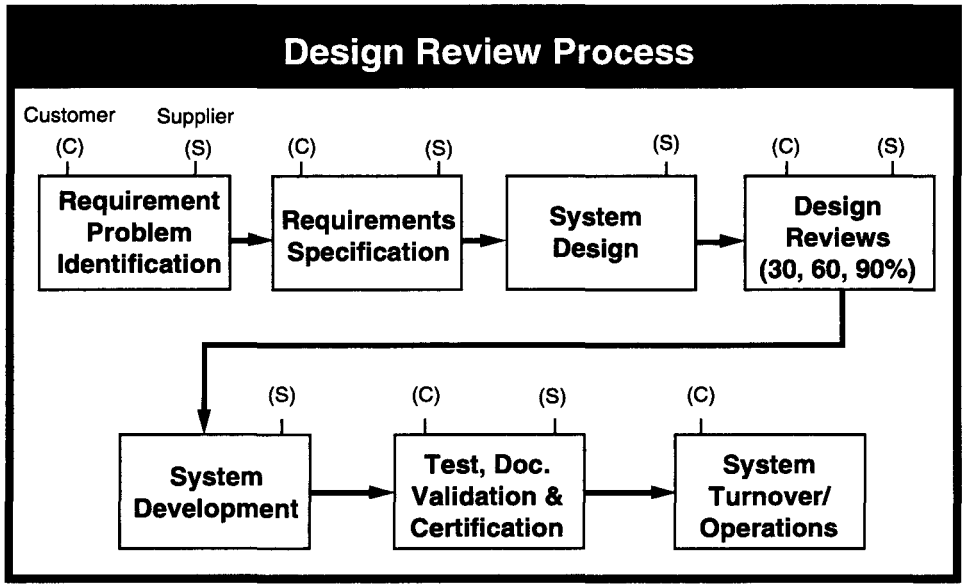


Figure 5.1.b.1 — Customer involvement improves our design review process

ensure the solutions are acceptable to the customer, identify and plan for long lead items and implementation costs, and establish the project budget and schedule.

Another service we developed that exceeds customer requirements is design visualization. We produce high quality three- dimensional computer graphics, animation, and simulations of complex spacecraft, facilities, support equipment, systems, and processes to exact dimensional standards. We use this technique to perform complex and demanding evaluations such as conflict analysis and operational flow scenarios; three-dimensional modeling of facilities, ground support equipment and flight vehicles; space and weight evaluation; space station renderings; and animation, conceptual modeling, and development of robotics systems and applications. This capability has allowed us to reduce waste and lost time by avoiding operational pitfalls before they happen. Cost avoidance results are discussed in Section 6.2.

5.1.c

The ultimate measure of the effectiveness of our quality in Shuttle processing operations is the success of each mission and the safe return of an orbiter and its crew. To this end, we have developed rigorous processes by which all KSC work is defined, managed, and tracked. We have developed and incorporated into these processes numerous programs and initiatives aimed at ensuring that we are constantly improving our measures of safety and quality. Some of these programs include the Structured Surveillance Program, Weekly Task Team Leader Meetings, expansion of safety training, and a monthly audit program that reinforces close attention to detail. The various measures implemented to improve our processes have yielded significant improvements in safety and quality along with the associated cost avoidance experienced when we are able to concentrate on processing rather than problem resolution. Some activities and results are discussed in Sections 5.3 and 6.

During the period from late 1989 through the present, the average labor hours required for mission processing were reduced by approximately 36 percent, as shown in Figure 6.2.6. This reduction was due predominately to maturation of the work force (including government and contractor management), continuous improvement accomplishments, and the fruition of numerous efficiency efforts. The mission processing labor hours have basically stabilized since FY92, but at the same time, additional requirements were implemented, such as the Mir mission requirements (orbiter docking system) and the fifth tank set, which is required to support longer duration Shuttle missions. Additionally, since FY91, the Shuttle Processing Contractor (SPC) work force was reduced by greater than 20 percent, a substantial reduction in cost of approximately $70 million.

An example of a system that fosters efficiency improvements is the Shop Floor Control/Data Collection System, a state-of-the-art computer application developed in 1991. This system has enabled engineers and supervisors to identify, investigate, and repair problem areas as they arise, which has directly contributed to the reduction of processing labor hours. It has also provided a common database of processing problems that enables a proactive, long-term approach to process improvements through trend and root-cause analyses.

Representatives of eleven NASA and contractor organizations improved the design/construction process by reducing the number of submittal requirements and simplifying the approval process for the purpose of reducing response times/costs and

improving facilities and customer satisfaction. The team obtained consensus to delete approximately 30 percent of KSC's construction submittal requirement. Furthermore, these efficiencies are applicable NASA-wide as the process is improved through the agency's SPECSINTACT program, which is a boilerplate construction specification.

5.2 Process Management: Product and Service Production and Delivery

5.2.a

Our key processes are defined in the KSC Strategic Plan discussed in Section 3. We manage these processes by:

- Establishing key milestones and objectives with our customers
- Tracking progress through metrics and daily status
- Taking action to improve negative trends

In particular, we manage the primary and support processes to Shuttle and payload processing very carefully to ensure the highest levels of customer satisfaction and to meet our challenging budgetary constraints. This was discussed in Section 2.1.

We have been very successful in reducing processing costs at KSC. We have done this by evaluating all processes and subprocesses that directly or indirectly support Shuttle and payload operations to identify areas for improvement, benchmarking, reengineering, or other operational analyses. The reductions achieved in Shuttle processing costs are the cumulative result of thousands of individual process improvements that collectively have made a large impact.

We manage our critical processes by having daily status reports, metrics, and formal reviews at major schedule milestones. The quality data we manage was summarized in Section 2.1.b.1. In particular, we have managed flight hardware processes to reduce the problem report rates and eliminate non-value added work. We have paid careful attention to other quality measures such as In-Flight Anomalies and quality surveillance records to ensure the highest quality standards for processing. These are discussed in Section 6.1.

5.2.b

We strive daily to improve the efficiency of our operations. Our activities include eliminating waste, improving efficiency through process analysis and other tools, eliminating work stoppages, and conducting comparative analysis, such as benchmarking, for the purpose of setting goals. Improvement teams are staffed by process owners, customers, and suppliers.

We improve our processes to achieve better quality through baselining and benchmarking the processes against comparable processes; using alternative technologies that will reduce cycle time and simplify operations; and soliciting customer feedback, reviewing the feedback, and implementing controllable suggestions.

Shuttle Processing Enhancements

Important examples of our success in the ongoing use of metrics are the Shuttle Processing Contract overtime percentage analysis; solid rocket booster (SRB) stacking enhancements; reductions for Ground Support Equipment (GSE) open paper and backlog; and thermal protection system processing enhancements.

Decreasing overtime usage through refined methods of resource management has been an ongoing effort and a management priority for many years. As shown in Figure 6.2.7, overtime usage has been steadily decreasing, which is attributable to a Centerwide maximum worktime policy (Kennedy Management Instruction 1700.2) along with the use and analysis of overtime metrics.

A processing area in which KSC has seen considerable improvement is in SRB stacking. Problems and time-consuming delays associated with SRB stacking prompted the Shuttle Processing team to improve this process. Proposed solutions were identified and tracked as Launch Flow Enhancement, which included hardware improvements, process refinements, and specification changes. The results of these enhancements are discussed in Section 6.2 and Figure 6.2.9.

Several factors, such as KSC inspectors cross-training and communicating with the Solid Rocket Motor vendor quality department to develop inspection consistency, have positively influenced the continual problem reports and stacking time reductions. A prime example of efficient problem resolution was the field joint O-ring contamination issue. SPC inspectors flew to Utah to review the vendor's inspection operation and demonstrate our process, resulting in the implementation of several process enhancements. These and other ongoing efficiency improvements have significantly reduced the problem report count to an average of 52 for the past two years.

Shuttle management tracks

Ground Support Equipment (GSE) open paper and preventative maintenance backlogs. In 1992, we had more than 6,700 open paper items and a maintenance backlog of almost 800 items. To address the problem, management and employees developed a plan to reduce the number of open items. Improvements include a steady reduction of open paper (e.g., work not completed or problems not corrected) and minimization of the delinquent maintenance backlog, as seen in Figures 6.2.12 and 6.2.13.

Throughout KSC, workers have become increasingly aware of the need to increase efficiency, improve processing methods, and reduce labor requirements. This is especially apparent in the Thermal Protection System (TPS) where workers took a proactive approach to eliminating the numerous impacts on Shuttle processing caused by thermal protection system problems and discrepancies. They established a CI team composed of representatives from multiple NASA centers and contractor organizations to review, recommend, and approve design and processing enhancements at the team's weekly meetings. Enhancement suggestions were submitted, recommendations were thoroughly evaluated, and many were implemented with impressive results.

Innovations, such as the laser step-and-gap tool, have reduced the complexity and intensity of certain tasks and have increased the overall accuracy and repeatability of measurements, allowing a reduction in requirements through the application of statistical process control. The list of successes is long, and each success is due to the effectiveness generated through the team concept. The team's success was attributed to using the CI process and strategically prioritizing areas to attack. The net result of these efforts was to improve TPS operational efficiency and to decrease Shuttle processing costs. This is demonstrated in Figure 6.2.8.

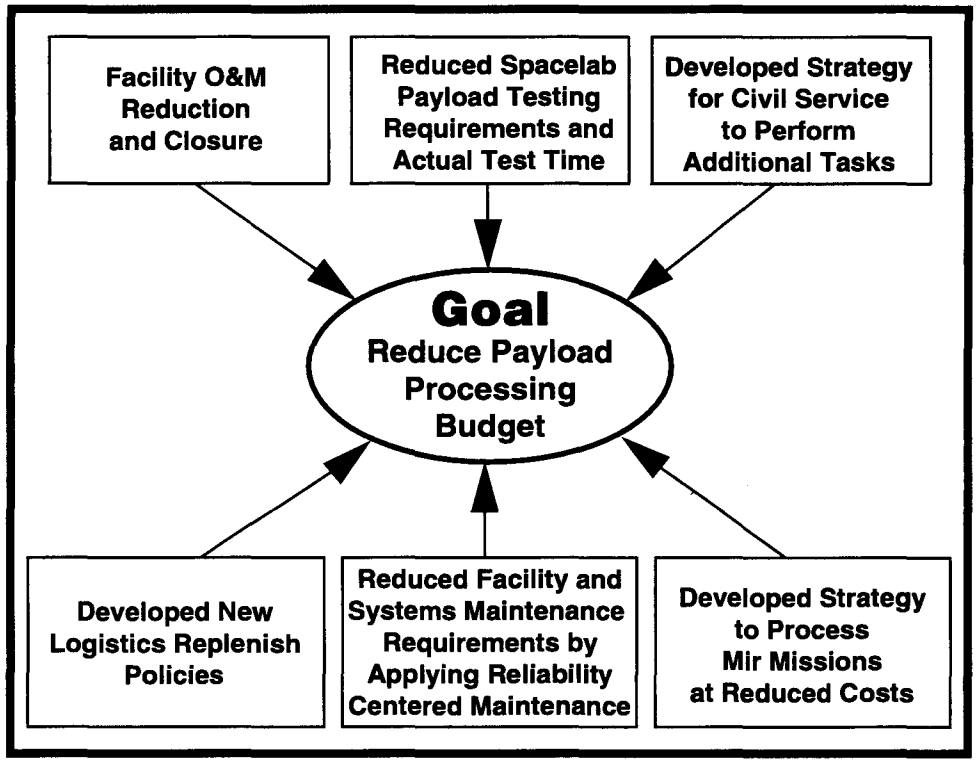


Figure 5.2.b.1 — Meeting our FY95 budget reduction

The team continues to evaluate and implement new ideas to improve the quality of the TPS processes and meet future budget requirements. A recent innovation is the development of a pen-based computer system for the disposition of discrepancy reports during postflight inspection.

Payload Processing Enhancements

In 1992, Payloads had to identify ways of absorbing significant budget reductions due to Shuttle program cuts. Our ability to meet this challenge and support the same number of missions per year was due in large measure to the application of CI principles. KSC team initiatives were implemented: structured surveillance, cutbacks in shift operations, development and implementation of a paperless documentation system, elimination of ground systems development projects, computer-based training, and overall efficiencies. Our payload processing team has been able to achieve those reductions and still maintain the required levels of excellence in terms of safety, reliability, quality, and on-time delivery.

In 1994, we were challenged to reduce our budget by 16 percent and support a flight rate of eight missions per year. This new challenge was more difficult to achieve since we had already streamlined the operation in the two previous years. Through innovative team work with our payload contractor, we met our FY95 budget using strategies in Figure 5.2.b.1.

We met our goal of processing eight flights a year with less contractor labor through several initiatives, including achieving process im-

provements in more than 40 areas of Spacelab processing. In Figure 6.1.5 we illustrate the dramatic reduction in Spacelab problems caused by incorrect testing procedures and missing data, as well as the reduced cycle time that we have achieved. Section 6.2 discusses our continuing reductions in Spacelab labor trends that have significantly lowered labor costs.

In addition, we use several predictive analysis methods to improve efficiency. The multiflow assessment identifies long-range needs and related shortages and conflicts. Near-term resource availability (e.g., work force, equipment, parts, work documents, and special skills) is analyzed daily based on the payloads integration control schedule. Remedial actions include rescheduling tasks, prioritizing support services, acquiring additional parts and equipment, redeploying the work force among the various work areas, and sharing resources through parallel tasking. We produce a weekly schedule reconciliation report to track our performance trends and determine the accuracy of work completion projections.

Safety and Quality

Safety is of paramount importance to KSC processing operations. Therefore, measuring safety improvements is essential to the Space Shuttle Program. One indicator of increased processing safety is the significant decrease in the number of processing incidents. Figure 6.1.1 shows the downward trend that has occurred over the past seven fiscal years. Since FY89, incidents have been reduced 96 percent. Newer initiatives will continue to lower the number of incidents. A pilot program to report close calls is in place to make employees more aware and involved in improving work situations that have a potential for risk.

The lost-time occupational injury/illness rates show the frequency of lost-time injuries of private sector and Federal agency organizations for the last nine years. Lost-time injuries are job-related injuries, as discussed in Section 6.1. The trend lines show rates for the overall private sector, private sector manufacturing organizations, private sector aerospace-related organizations, all Federal agencies, all of NASA, and all civil service personnel working at KSC. KSC is below the private sector aerospace-related organizations and also below the NASA average.

Benchmarking

Our benchmarking approach was described in Section 2.2, and the results are being implemented to achieve incremental as well as breakthrough improvements in process quality.

5.3 Process Management: Support Services

5.3.a

Requirements for our key business and support service processes are determined by Federal law, NASA Headquarters, and other Federal agencies, such as the Environmental Protection Agency, the Government Accounting Office, and the Office of Personnel Management. We also establish requirements for support with our internal customers. As discussed in Section 3, the KSC Strategic Plan identifies requirements and measurements for maintaining and improving process quality.

The Comptroller's FY95 CI Plan contains the systemic processes used by the organization for improvement of quality and operational performance. It examines the products and internal and external customers and also establishes the approximate times at which the processes will be examined.

In another process, the contractor work force rate review is used to develop rates for pricing labor requirements of major contractors for budget purposes and as a forum to manage contractor rate growth and therefore slow the escalation of costs from year to year. These rates are established through a rate review forum with representatives of the Comptroller and Procurement Offices.

In support of the toxic chemical database inventory, KSC was able to meet a Federally mandated requirement through the coordinated efforts of a Centerwide NASA/contractor team of environmental professionals. The team has routinely shared strategies and methodologies and provided the structure and leadership to collect chemical usage and release data for integration into a comprehensive KSC facility report.

5.3.b

Our key business and support service processes are managed by establishing requirements for support with our internal customers, identifying areas for improvement, tracking performance through metrics, and taking action to improve negative trends. We manage our internal customer/supplier relationships by establishing teams with the primary process owners, actively soliciting feedback, and establishing KSC standards for procedures and quality specifications.

We also manage our processes through contracting incentives and concise communications. The award fee process, discussed in Section 5.4.a, provides meaningful measures and continual feedback to contractors on their level of support in achieving these goals. Semiannually the contractor is provided specific criteria for customer satisfaction. The criteria are used as the basis for contractor evaluation. Intermediate evaluations are also provided to measure progress against the established goals and assist the contractors in achieving them. Performance is continuously monitored and discussed with the contractor.

Other communication channels, established specifically to maintain the performance of our support processes, include monthly counterpart meetings and weekly and daily scheduled tag-up meetings. Our contractors have provided outstanding support, due in part to this process. As seen in Figure 6.3.1, trends for contractor award fees show a steady improvement.

In the Procurement Office, the Acquisition Management staff and Property Management Office provide support to three procurement operations offices. The Acquisition Management staff functions include industry assistance, policy and review, metrics gathering, and cost and pricing. Industry assistance includes identifying potential sources of supply for the contract specialists who are placing contracts and purchase orders, as well as supplying industry information on future acquisitions. Policy and review provide an internal audit function for procurement documentation and problem resolution. Cost and pricing provide the three operations offices in the Procurement Office with pricing support for negotiating a fair and reasonable price on our contracts. Property Management is responsible for the accountability of government property used by KSC's contractors.

In addition, timely planning and actions by a diverse group of individuals at the center have kept KSC compliant with chlorofluorocarbon (CFC) environmental regulations; diverted any potential threat to delays in Shuttle processing schedules caused by non-availability of CFC's in critical applications; reduced usage and release of environmentally harmful chemicals; and, in the long term, implemented more cost-effective technologies. This is discussed further in Section 5.3.c.

5.3.c

We strive daily to improve the efficiency of our operations by process analysis and by comparative analysis such as benchmarking and reengineering processes. We identify processes and establish teams to identify improvements. Improvement teams are staffed by process owners, customers, and suppliers. Examples of some of these are presented below.

A cross-functional team uses an integrated approach to process assessment of providing orbiter parts to the shop floor. The team, which includes the customer and logistics, engineering and scheduling, and shop personnel, is using quantitative data collected from the Shop Floor Control/Data Collection System to conduct root-cause analysis and develop recommendations for process changes that will prevent work stoppages due to parts delays.

KSC has also benefited from our discussions with Florida Power and Light in developing energy saving initiatives. KSC was the first NASA center to receive a cash rebate for energy saving efforts, with $404,000 in rebates received since 1993. This is shown in Section 6.2.

At the beginning of 1994, KSC's excess program required over 300 days to dispose of excess property. The standard established by NASA Headquarters for disposal of excess property was 210 days. A CI team consisting of NASA and contractor personnel was formed to reduce the disposal time to within the standard established by Headquarters. As a result of the improvements initiated by the CI team, the disposal time was reduced to approximately 100 days by the end of 1994 and to slightly over 65 days by May 1995. KSC is now recognized as one of the best in the agency in the timely disposal of excess property.

We have developed exceptional alternative technology solutions based on customer input and feedback. As an example, the Clean Air Act amendments of 1990 directs phasing out of production of CFC's and other ozone-depleting substances. KSC has historically relied heavily on CFC compounds as cleaning agents in Shuttle processing activities and as refrigerants in facility and ground support equipment. Through the efforts of a working group formed to address this issue, KSC has significantly reduced its use of CFC's, which is discussed further in Section 6.2. Personnel in the KSC Materials Science Division have developed and proven effective aqueous cleaning technologies as an alternative to CFC cleaning that is expected to significantly increase reductions in CFC usage when fully

integrated into operations by 1997.

Procurement has committed to improve and better utilize our institutional capabilities and processes. We have reviewed our source selection processes to improve acquisition planning and reduce resources used on source selections. We are also increasing use of electronic methods and techniques for more effective acquisitions. For example, synopses and solicitations for our mid-dollar range procurements are now available on the Internet. Further, we are identifying and pursuing initiatives to eliminate internal KSC and NASA barriers to the acquisition process.

We are expanding the participation of small and Small Disadvantaged Businesses (SDB's) at KSC to meet NASA-assigned goals. We have trend data showing that KSC has continued to meet increasing agency goals. NASA Headquarters sets goals for each center to award a certain amount of prime and subcontract dollars to small businesses, small disadvantaged businesses, and woman-owned small businesses. The results of these initiatives are shown in Figure 6.3.2.

Public Affairs measures customer satisfaction of external customers through various forms of evaluation, including personal interviews, phone interviews, and written surveys. Surveys are conducted on the satisfaction of news media; satisfaction with student programs and teacher workshops; satisfaction of guest arrangements for the viewing of launches and landings; and visitors satisfaction with facilities, services, and personnel involved in the visitor center. For example, based on feedback from in-person interviews conducted by an outside survey company, more than $6 million was saved in construction of the Apollo Saturn V Center; a major new tour facility to be opened in late 1996. The information helped improve the design to give visitors maximum flexibility in tour decisions and size the facility to meet the expected stay time of the visitors.

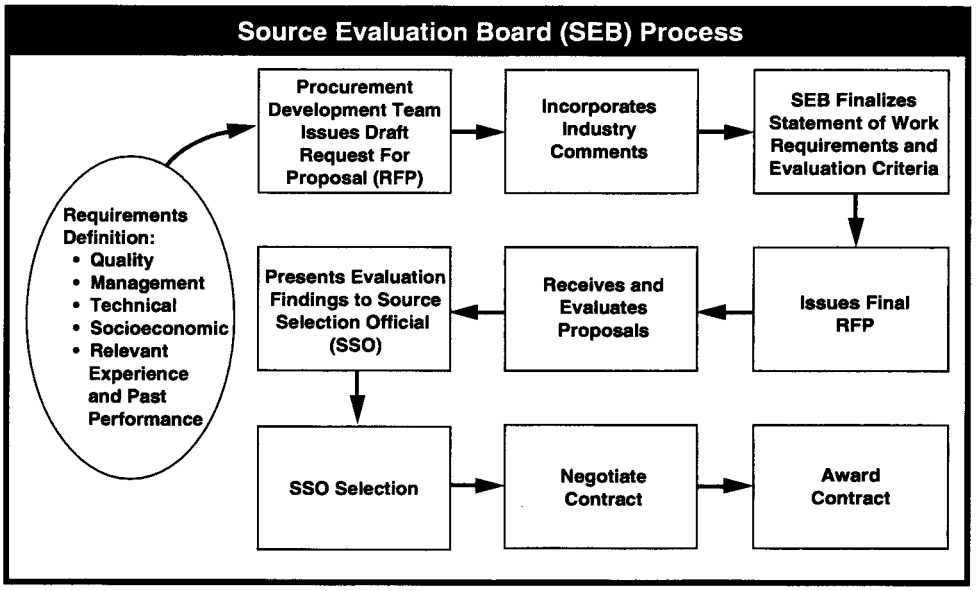


Figure 5.4.a.1 — Our Source Evaluation Board process incorporates quality requirements in the selection process

The KSC Exchange Council conducted a survey of KSC employees to determine future development activities for the Kennedy Athletic and Recreation Society. Based on survey results, which identified requests for new or improved activities and facilities, the Council formulated and approved a facilities development plan to implement many of the requests as funding becomes available.

5.4 Management of Supplier Performance

We define supplier and intermediary quality as the quality of the products and services provided by our prime contractors, their subcontractors, and our other suppliers. Our suppliers' quality results are presented in Section 6.3.

5.4.a

We systematically develop the requirements of our products and services based on our customers' needs; that is, their need for safe, on-time, cost-effective Shuttle missions. Our requirements are incorporated in our procurement packages, and suppliers are selected through our competitive procurement process, illustrated in Figure 5.4.a.1.

On major acquisitions, KSC defines its operational requirements by assembling Procurement Development Teams (PDT's). PDT members include procurement, quality, and management personnel and technical experts. The PDT defines the requirements, which are incorporated into requests for proposals (RFP's). Draft RFP's are usually issued for industry comment on our largest-dollar procurements. Potential suppliers provide feedback on the requirements. KSC considers all comments, incorporating changes where feasible. This process ensures not only that our requirements are clearly defined but also promotes competition to the maximum extent practicable.

A Source Evaluation Board (SEB) process is used to competitively select major suppliers/contractors. The SEB, consisting of PDT members and additional evaluators and experts, evaluates contractor proposals using criteria established in the RFP. The evaluation criteria for each procurement are tailored, based on the essential performance characteristics of the item or service being acquired. SEB findings are presented to the source selection official, who makes the selection based on "best value," with price and other factors considered.

For products and services not acquired through the SEB process, we involve appropriate personnel in reviewing requirements during planning and acquisition and in recommending appropriate standards.

We conduct pre- and post-award surveys to ensure that suppliers understand and can comply with our requirements. We also maintain a database of suppliers that identifies past performance, the results of the last survey, and the current acceptability of the supplier. Our prime contractors also have vendor rating systems and databases designed to ensure acceptable products and promote viable partnerships with suppliers.

We formally reinforce requirements semiannually to our prime contractors through specific areas of attention in the award fee criteria, as shown in the Payload Ground Operations Contract relationship presented in Figure 5.4.a.2.

Additionally, requirements are discussed in design reviews and regularly scheduled meetings, are spelled out in project specifications or build-to-print documents, and are documented in design review meeting minutes. Some of the key indicators we use to evaluate suppliers are records of prior business with the agency, letters of recommendation, a brief description of the supplier's quality plan as required, and job site quality inspections of deliverables once a supplier is selected.

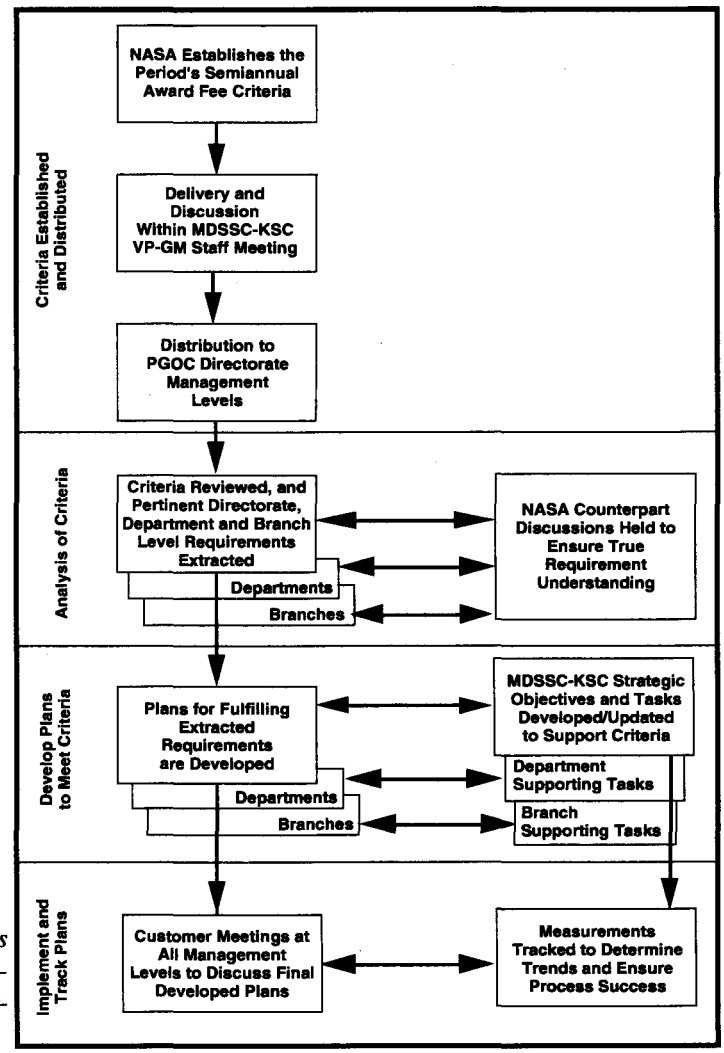


Figure 5.4.a.2 — KSC's award fee process reinforces customer preference requirements

In 1992, we began incorporating a "should cost" analysis for each six-month award fee period. We compare the "should cost" contract estimate with the actual contract costs and base an incentive fee payment on the contractor's cost management performance. We use these metrics for contract adjustments and performance improvement and to provide incentive for innovative cost reduction and waste avoidance measures.

Another way we ensure that our prime contractors are meeting our requirements is by assessing their metrics on a regular basis.

We ensure that our requirements are met by our product suppliers through quality audits, vendor certification and testing, and quality surveys. Depending on the criticality, complexity, and end-item usage, we perform detailed receiving and in-process inspections; and we witness acceptance testing at the suppliers' facilities. We have also established a survey and audit program that integrates government and contractor

activities into a standardized assessment approach. It defines reporting and training requirements; provides measurement methods to evaluate assessment results; and emphasizes process-oriented surveys and audits of engineering, operations, maintenance, safety, reliability, and quality assurance activities.

Overall, we use our survey and audit program assessment and our structured surveillance to enhance product quality and process efficiency. These programs are compatible with Centerwide CI initiatives and validate necessary requirements.

5.4.b

We track, assess, and document the overall performance of our contractors and suppliers and continually seek ways to enhance the effectiveness of our supplier management processes, as well as the quality of our suppliers' products.

For instance, in the development of a new KSC Public Visitor Program Concession Agreement, special emphasis has been placed on performance evaluations, continual improvement, and customer focus. Old concession agreements were not performance award fee based and had no formal performance evaluation process, continual improvement program requirement, formal requirement to solicit visitor input, and no formal requirement for recordkeeping of customer complaints. These areas are now addressed in the new agreement.

Requirements are communicated through the Statement of Work and other terms of the concession agreement. Performance criteria are "quality, timeliness, efficiency" plus "areas of emphasis" that are identified at the start of each six-month period. In addition, NASA and concessionaire personnel maintain open communication and feedback on a daily basis. It is felt this new agreement will encourage high quality performance, increase customer satisfaction, foster effective communications between parties, and encourage innovative cost improvements and efficiencies.

Process assessments are adding value as our prime contractors focus on correcting the root cause of problems identified through process analysis. Process analyses have also proven invaluable in identifying system weaknesses, inefficiencies, and unnecessary duplication.

For example, increasing Repair Turnaround Times (RTAT's) for failed Air Data Transducer Assemblies (ADTA's) prompted the formation of a process improvement team to evaluate and improve the repair process at Allied Signal Controls and Accessories, the original equipment manufacturer of the ADTA's. An integrated team of NASA, Rockwell and Allied Signal personnel was formed to review, analyze, and improve the repair process with particular emphasis placed on the repair process for the transducer components of the ADTA. The baselined average RTAT for one transducer was 304 days. The team established a goal of 150 days based on their understanding of process capabilities and support requirements for Shuttle orbiter processing. Through application of a nine-step approach to process analysis and improvement, process barriers and root causes of process problems were identified and solutions were implemented. A 67-percent reduction in the average RTAT has been experienced to date and will continue to be monitored to ensure soundness of process changes.

In 1990, we undertook a logistics direct-buy program to reduce the cost of acquiring Shuttle spares by eliminating unnecessary procurement subtiers. An integrated team completed nine candidate evaluations to assess direct procurement, yielding a projected cost avoidance of nearly $2.7 million for activated requisitions. Additionally, we are improving support by reducing product delivery schedules, identifying obsolete components and materials, coordinating unresolved design issues with subcontractors, and discovering the need to certify new suppliers to manufacture Shuttle program hardware.

In an effort to minimize the costs associated with verifying supplier performance, we have successfully implemented a structured surveillance program over the last four years with five of our major contractors involved in processing flight hardware. This program eliminates the requirement for mandatory inspection on noncritical tasks and replaces it with random sampling.

Since implementation, one of the benefits we have achieved is the virtual elimination of delays due to quality nonsupport. Data gathered during random surveillance has been analyzed with respect to the types of errors detected, allowing us to direct corrective action to the source of the most significant problems. The result is a better trained, more capable work team with ownership and accountability for quality. Section 6.1 addresses results of this effort.

6.0 BUSINESS RESULTS

Kennedy Space Center's successful process performance and improvement program center about our three critical core processes of Shuttle Processing, Payload Processing, and Safety. In addition, tremendous improvements have been demonstrated in our administrative and business support processes and services areas of Finance, Facilities, Engineering, Records Management, Environmental Protection and Conservation, Contracts, Procurement, and Logistics.

Section 6.1 shows multiyear trend data and current levels of product and service quality for our key business services. In Section 6.2, we provide trend and current data measuring cost performance, labor utilization, efficiency, and other process improvement initiatives for our organizational enterprise. Section 6.3 presents trend data and current performance for our key suppliers - both internal and external.

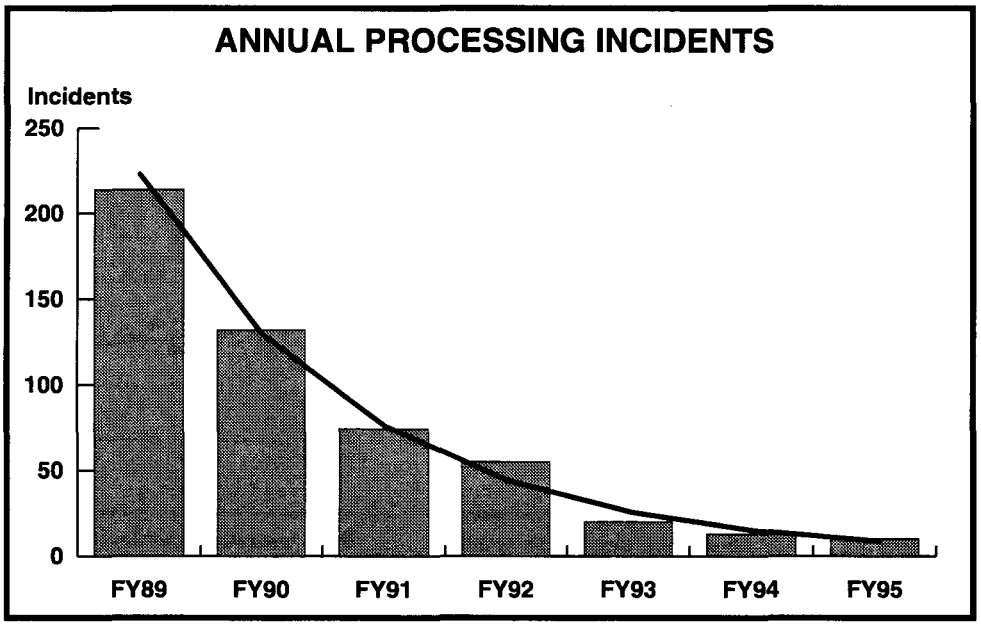


Figure 6.1.1 — Shuttle processing incidents declined 96 percent

6.1 Product and Service Quality Results

Due to the nature of the complexity and high risk of preparing manned vehicles for spaceflight, safety must be and is the paramount goal of our missions to space. To ensure safety, quality is a major driving force in the process. Since the Challenger accident, our increased emphasis on safety and quality has resulted in a continuing decline in a number of incidents and problems and hence corresponding improvements in overall operational safety, performance, reliability, and costs.

A summary indicator of processing safety is the number of Space Shuttle processing incidents. A significant long-term decrease is demonstrated in Figure 6.1.1, where the number of processing incidents has steadily decreased from a high of 214 in 1989 to a low of 10 in 1995. When we factor in the labor hours expended for a typical processing flow today of 700,000 hours times five flows to date, we find an incredible ratio for 1995 of 10 incidents per 3.5 million labor hours. This unprecedented performance is a result of heightened awareness, improved training, and

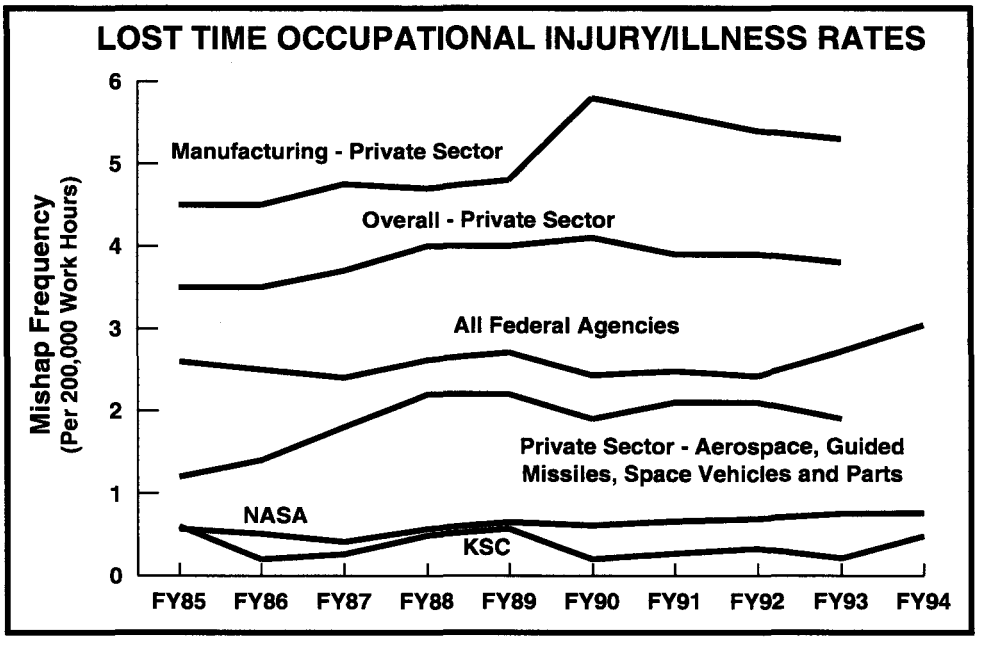


Figure 6.1.2 — KSC continues to enjoy the lowest mishap rate for all NASA centers and all related industry

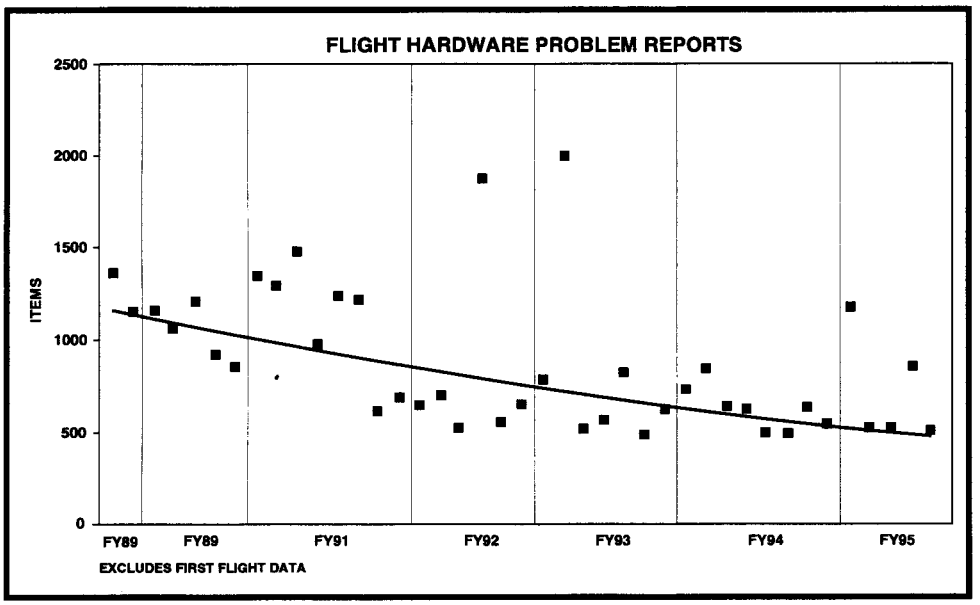


Figure 6.1.3 — A 56-percent decline in Space Shuttle flight hardware problems since return-to-flight

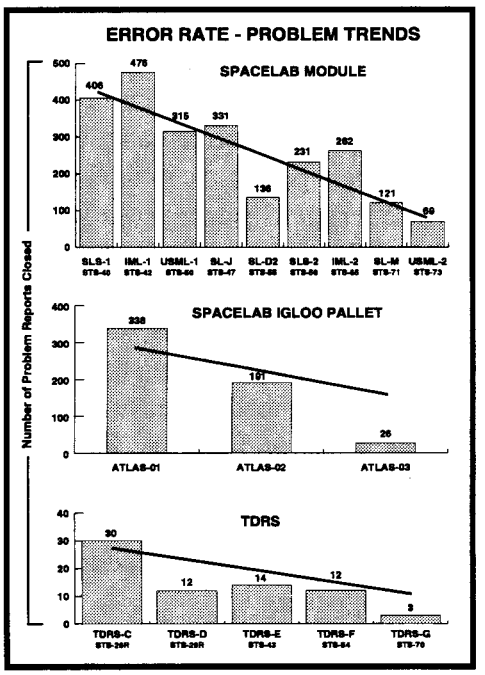


Figure 6.1.5 — Payload problem reports decrease

better tools and procedures for our work force.

In assessing another aspect of the effectiveness of KSC's safety program, we enlist the metric of lost time injury and illness rates for related industry groups as shown in Figure 6.1.2. For the last 10 years, we have maintained an occupational injury and illness rate below the national average for all other private sector and Federal organizations while continuing to improve operational performance.

As discussed in Section 5.1.c, the ultimate measure of our quality performance in Shuttle processing operations is the success of each mission and the safe return of an orbiter and its crew. Problem reports generated during a particular Shuttle processing flow have proven to be a useful quality indicator, which aides in detecting, correcting, and preventing problems as well as managing the processes. As shown in Figure 6.1.3, the number of flight hardware problem reports per processing flow has steadily declined by more than 56 percent since the return-to-flight following Challenger.

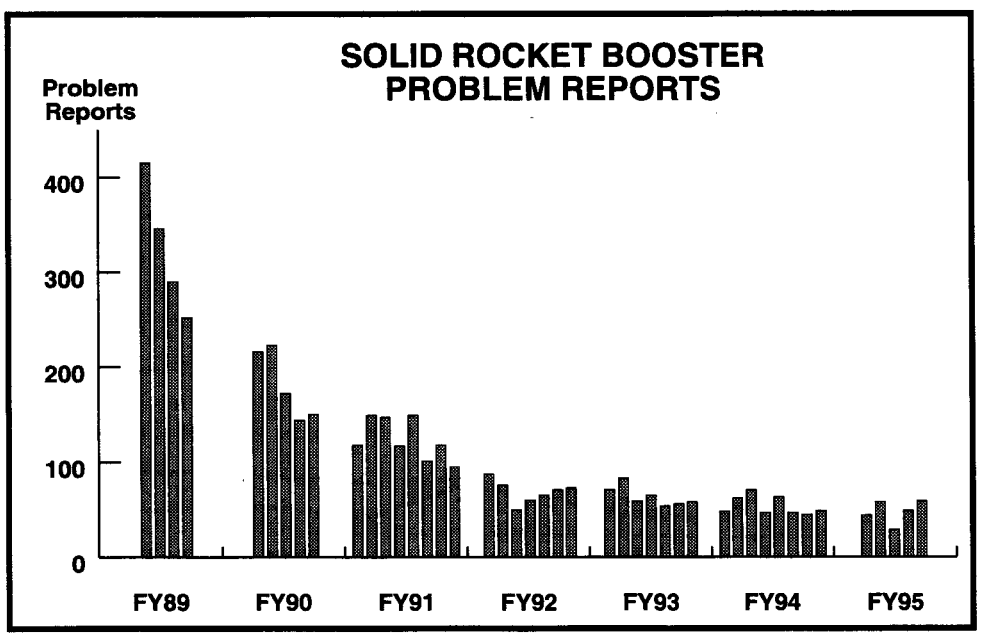


Figure 6.1.4 — A significant decline in hardware problem reports

Once troubled with problems and time-consuming delays, stacking problems of the SRB's have seen a remarkable turnaround as a result of improvement initiatives of several teams, reflected in Figure 6.1.4.1.

Similarly, we have experienced significant downward trends in payload problems reported in the Spacelab Module, Spacelab Igloo pallets, and the Tracking and Data Relay Satellite (TDRS) processing flows. As shown in Figure 6.1.5, Spacelab Module problem reports have been reduced by 83 percent, Spacelab Igloo by 92 percent, and TDRS by 90 percent.

On an individual basis, problem reports per technician are used as a

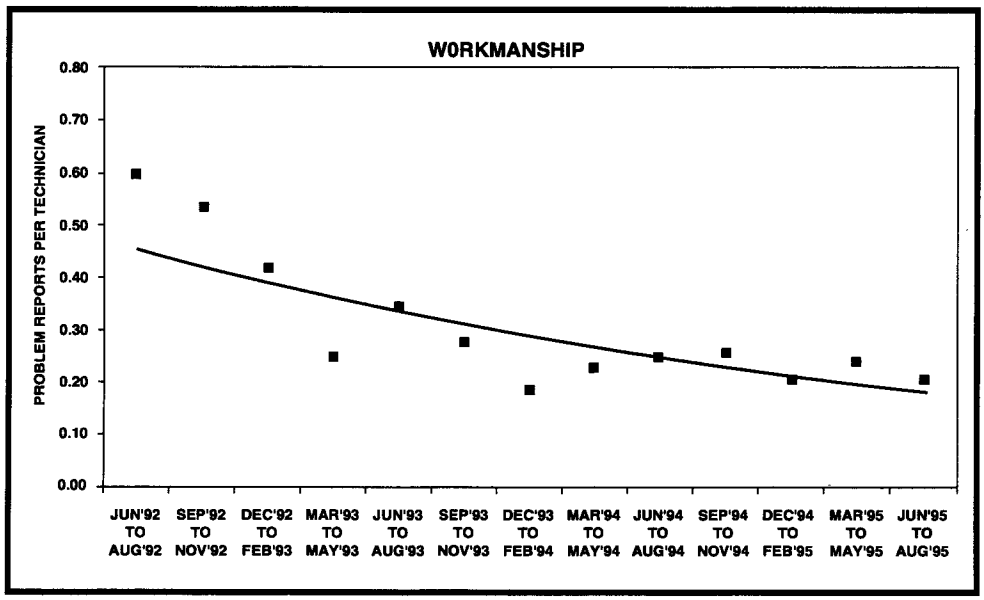


Figure 6.1.6 — Workmanship quality has improved significantly since June 1992

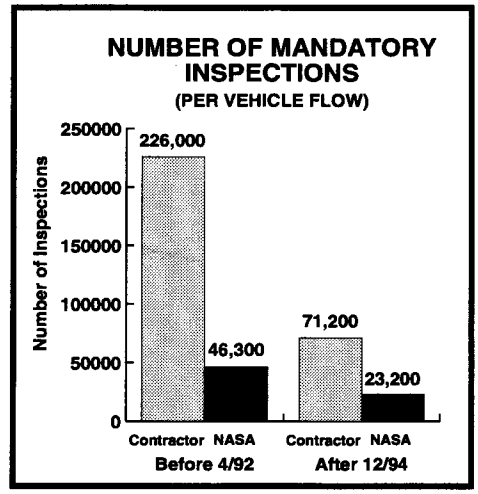


Figure 6.1.7 — The number of inspections has been significantly reduced due to implementation of our structured surveillance program

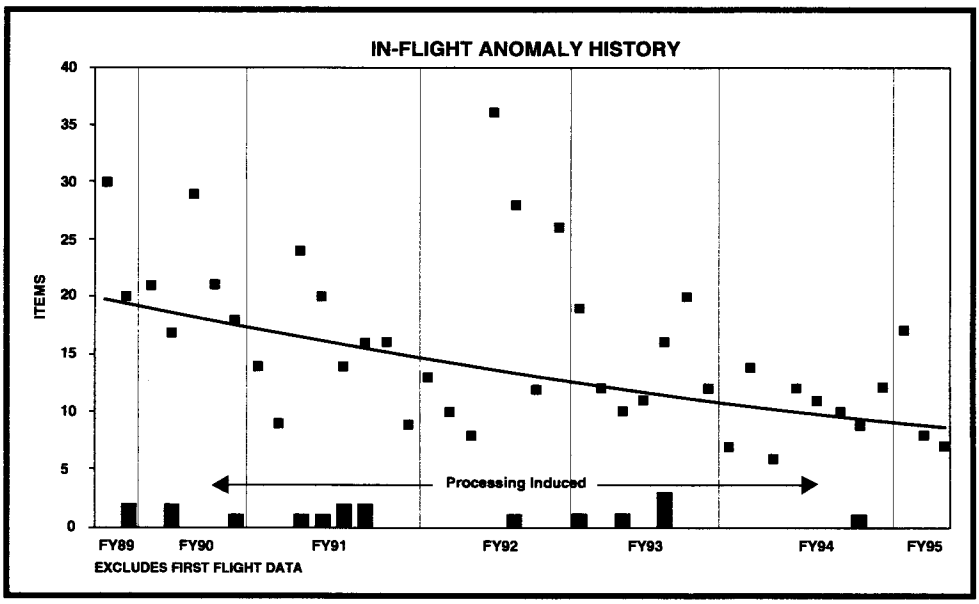


Figure 6.1.8 — Decrease in in-flight anomalies means a safer and more successful mission

general measure of workmanship quality. Consistent with other quality measures, problem reports per technician have similarly improved in the past few years as shown in Figure 6.1.6. Even though the technician headcount has steadily decreased during the reporting period, the workmanship indicator for the processing team has improved by 65 percent from the June to August period in 1992 to the same three-month period in 1995. The problem report rate has been holding at this minimal level for the past two years.

Our implementation of structured surveillance has optimized the number of inspections conducted by NASA and our contractors. For example, the number of mandatory inspections performed has been reduced as shown in Figure 6.1.7. This change has been accomplished while maintaining the high quality of the delivered flight hardware as shown in Figure 6.3.5. The effectiveness of our structured surveillance program is also demonstrated by the decrease of in-flight anomalies shown in Figure 6.1.8. These improvements helped to decrease overall processing costs discussed in Section 6.2.

6.2 Organization Operational and Financial Results

Operational performance results are those that capture cost reductions, improve labor utilization, and reduce cycle time. We track those results for our critical processes of Shuttle and payload processing and safety, as well as for our institutional support.

Our multiyear trend data indicates the need for applying CI efforts in reducing the total Center's cost of operations. As shown in Figure 6.2.1, the current projection for our FY97 operating plan will be 31 percent less than the adjusted FY92 congressional plan. Figures 6.2.2, 6.2.3, and 6.2.4 show the extent to which Shuttle, payload processing, and institutional support have contributed to the reductions. Cost reductions must not impact mission manifest rate, and safety must remain the number one priority.

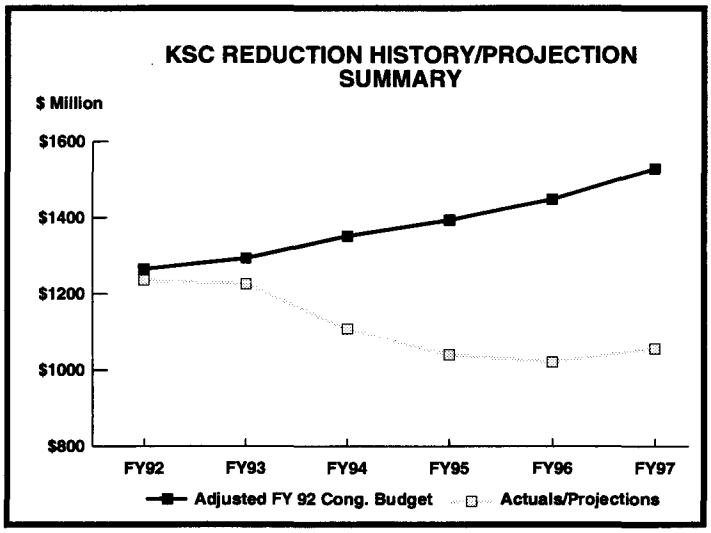


Figure 6.2.1 — KSC cost reduction

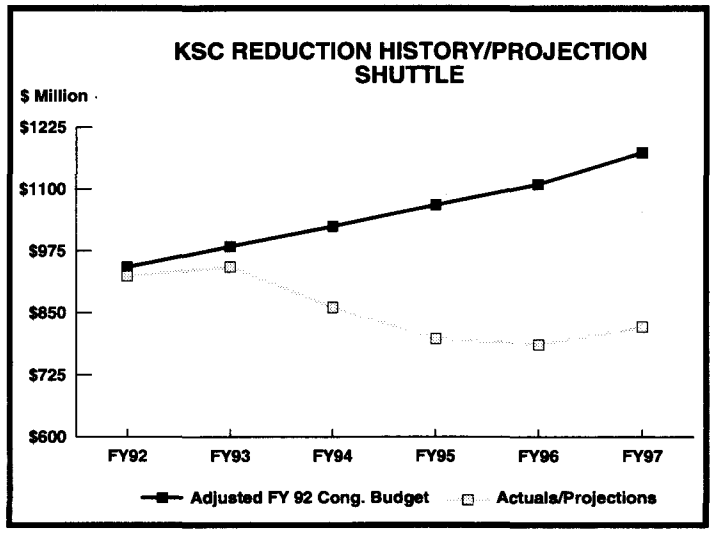


Figure 6.2.2 — Shuttle processing cost reduction

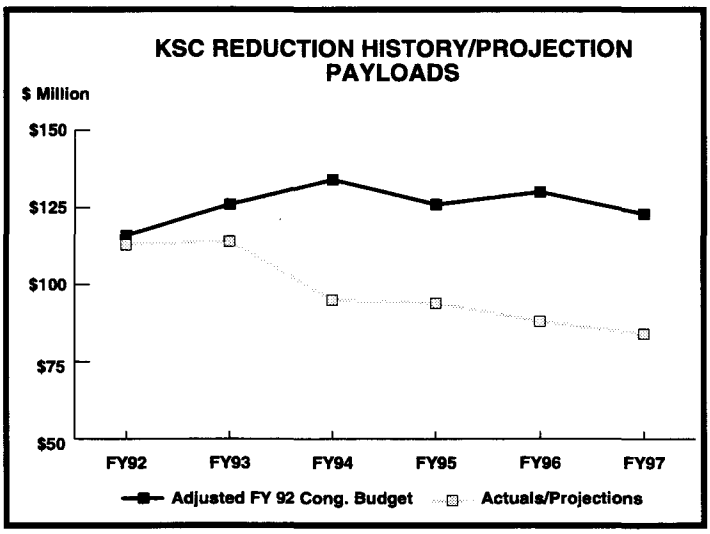


Figure 6.2.3 — Payload processing cost reduction

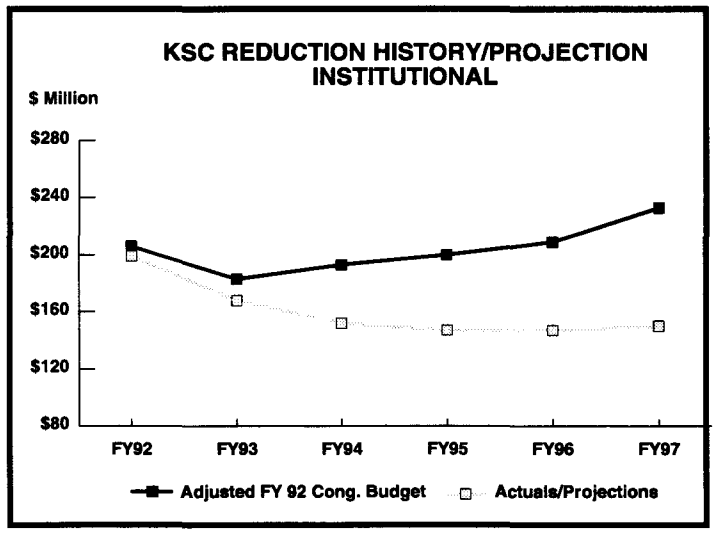


Figure 6.2.4 — Institutional support cost reduction

One of the most significant indicators of operational performance is cost per flight as shown in Figure 6.2.5. The cost-per-flight reductions demonstrate the improved efficiency and effectiveness of processing and launching Shuttle missions. In 1989, the cost per flight was $183 million. In 1995, it is $128 million, a $55 million cost savings (avoidance) per flight. The improvement shown is the result of a broad spectrum of CI initiatives including improved equipment and work package design, better scheduling, and higher production quality.

As the result of a continuing focus on improving our processes and operational effectiveness, we have reduced the labor required for Shuttle processing from nearly 1.1 million hours per mission in FY89 to approximately 0.7 million hours in FY95 as reflected in Figure 6.2.6. This is a 36-percent reduction in average processing time, with an associated total labor cost avoidance of approximately $12 million per mission or roughly $96 million per year (for an eight flight year).

Process improvements to reduce regular labor hours have carried over into the reduction of overtime. Cross-functional process reviews, problem-solving teams, and better planning have all led to a 77-percent reduction in overtime usage from a 11 percent average in 1989 to less than 3 percent in 1995 as shown in Figure 6.2.7. The direct dollar savings contribution of this effort has been about $20 million per year without any compromise to safety or schedule. In fact, both have improved during this overtime reduction period.

Early in the Shuttle program, repairing, rebonding and waterproofing the 30,000 plus thermal heat tiles

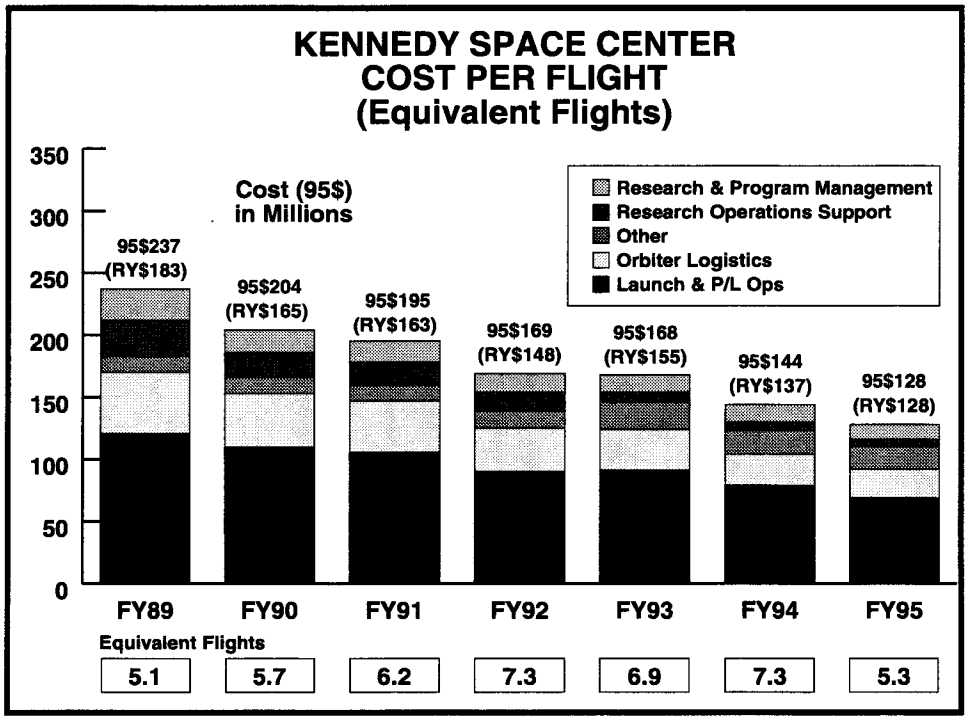


Figure 6.2.5 — Cost per flight steadily declines since return-to-flight

for the orbiter was one of the major labor and schedule challenges in the mission flow. In 1991, an effort was made to improve the process by collocating shops and materials, developing automated tools, and providing better information systems. Also, many of the tiles were replaced with insulation blankets that are much less costly to maintain. Today, the work can be accomplished better, faster, and at lower cost. Figure 6.2.8 depicts the recent results of the enhancements in terms of tile technician labor required to support a Shuttle mission.

Cycle time of the solid rocket booster stacking has improved 63 percent, largely due to the reduction of the number of problem reports

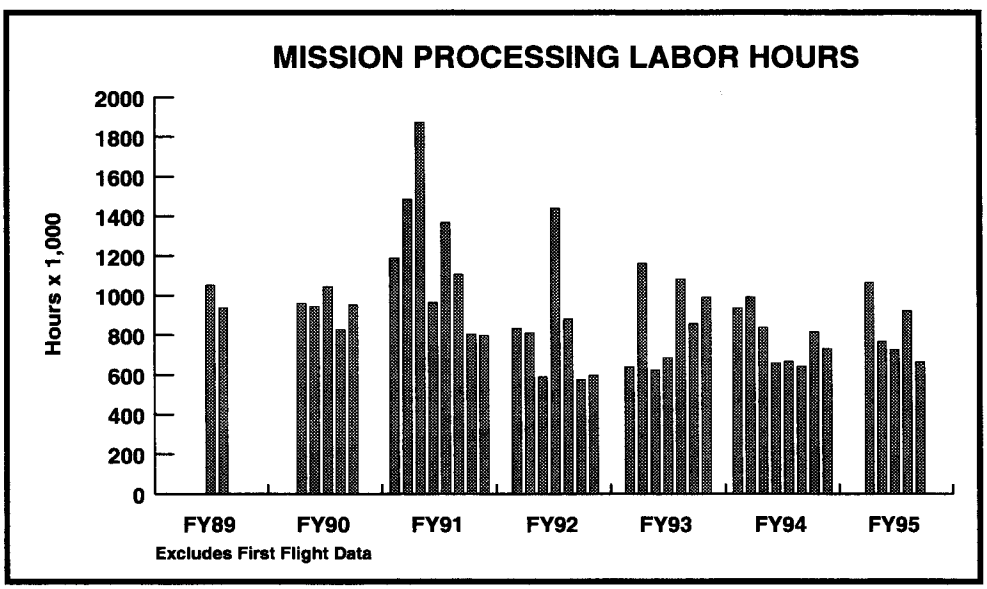


Figure 6.2.6 — Improvements lead to lower mission processing labor hours

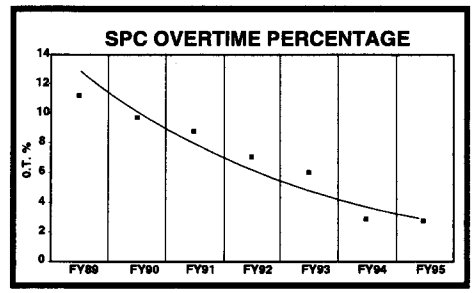


Figure 6.2.7 — Overtime reductions have saved $20 million per year

generated in the process, as shown in Figure 6.2.9. This reduction was accomplished by improving hardware design, developing better procedures, focusing employee training, and working with our supplier to eliminate problems at the source. Since solid rocket booster stacking is a hazardous operation, decreasing stacking time also reduces exposure to safety risks.

Payload processing, our second major enterprise, also continues to be more efficient. Efforts focused on preparing Spacelab modules, Spacelab Igloo pallets and TDRS for flight have netted a 62-percent, 42-percent, and 86-percent reduction in labor hours respectively since STS-40 in 1989 as reflected in Figure 6.2.10.

Similar improvements of 77 percent, 35 percent, and 16 percent in the schedule trends of payload processing for Spacelab, Igloo, and TDRS are shown in Figure 6.2.11.

Operational readiness of our ground support equipment (GSE) is another crucial factor in improved productivity for Space Shuttle and Payload Processing. Our support organizations track GSE open paper and preventative maintenance backlogs to enhance the operational readiness of our GSE as reflected in Figures 6.2.12 and 6.2.13. Annually, we accomplish approximately 9,000 maintenance tasks on GSE. At the

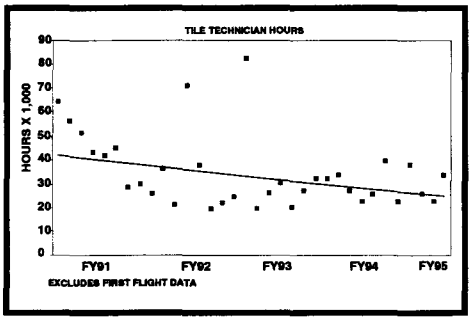


Figure 6.2.8 — Tile processing enhancements improves efficiency, cost, and schedule

beginning of 1992, we were carrying in excess of 6,700 open paper items, and our maintenance backlog had grown to approximately 800. Today, open paper is down by 60 percent and the backlog has been below 50 for the past 31 months.

Additional cost savings have been achieved through technology utilization such as design visualization, as discussed in Section 5.1.b. This improvement has resulted in a savings of nearly $200K and 6,000 hours since its implementation 30 months ago as shown in Figure 6.2.14.

Facility condition assessments, based on the evaluation of an external independent organization, are used as comparative benchmarks for evaluating the effectiveness of facilities provided to customers. As indicated in Figure 6.2.15, the 1995 survey results show KSC was 6.7 percentage points above the NASA average and nearly 4 percentage points above the industry average. In this benchmarking study, specific data points (in addition to averages) were provided to process owners so they could search out best practices and set true stretch targets.

KSC continues to exceed our strategic plan goals of energy consumption avoidance. Our accomplishments versus our goals can be seen in Figure 6.2.16. In addition, we

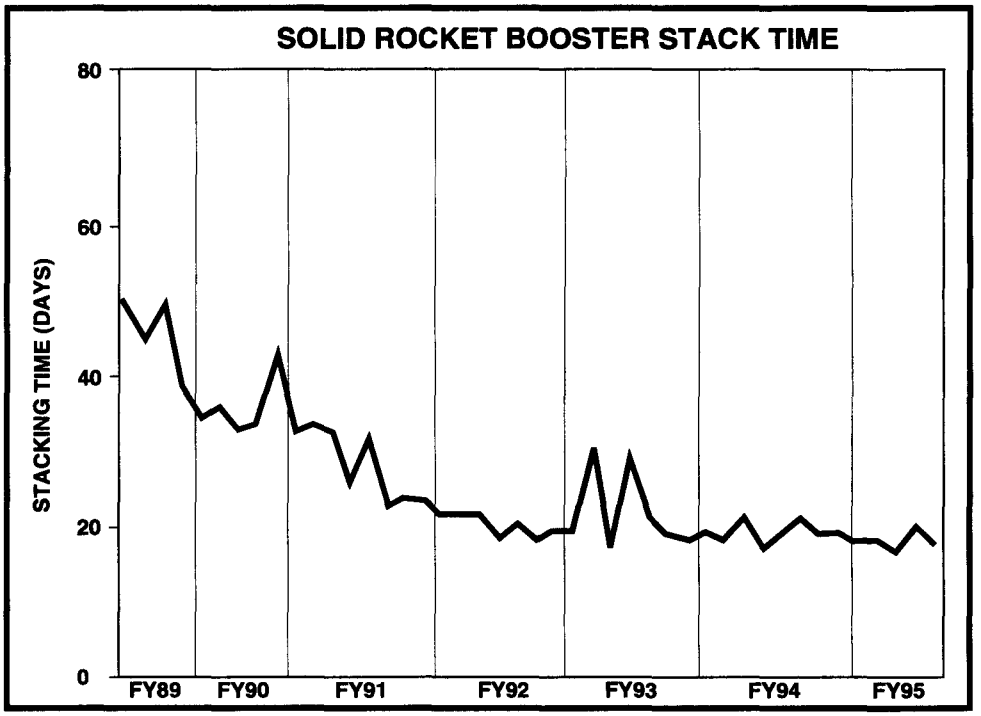


Figure 6.2.9 — Decreasing solid rocket booster stacking time also decreases safety risks

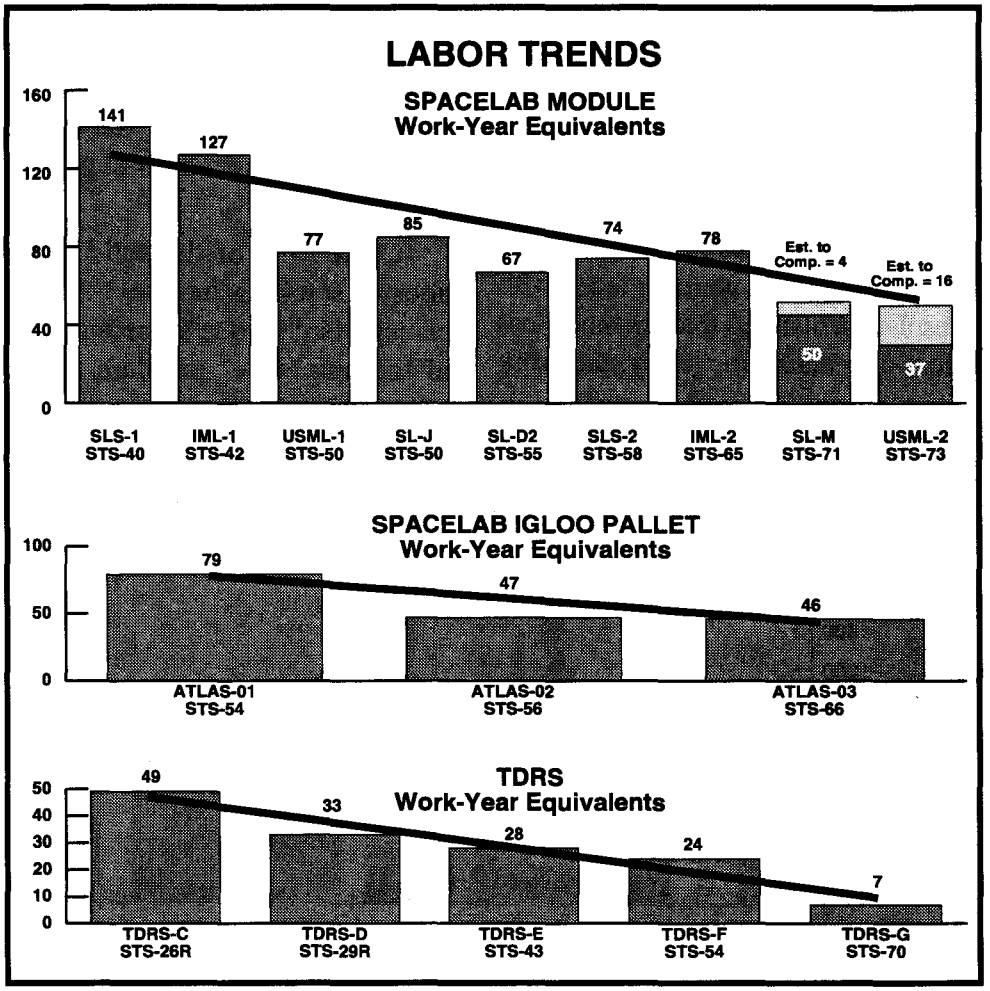


Figure 6.2.10 — Reduced payload labor processing hours

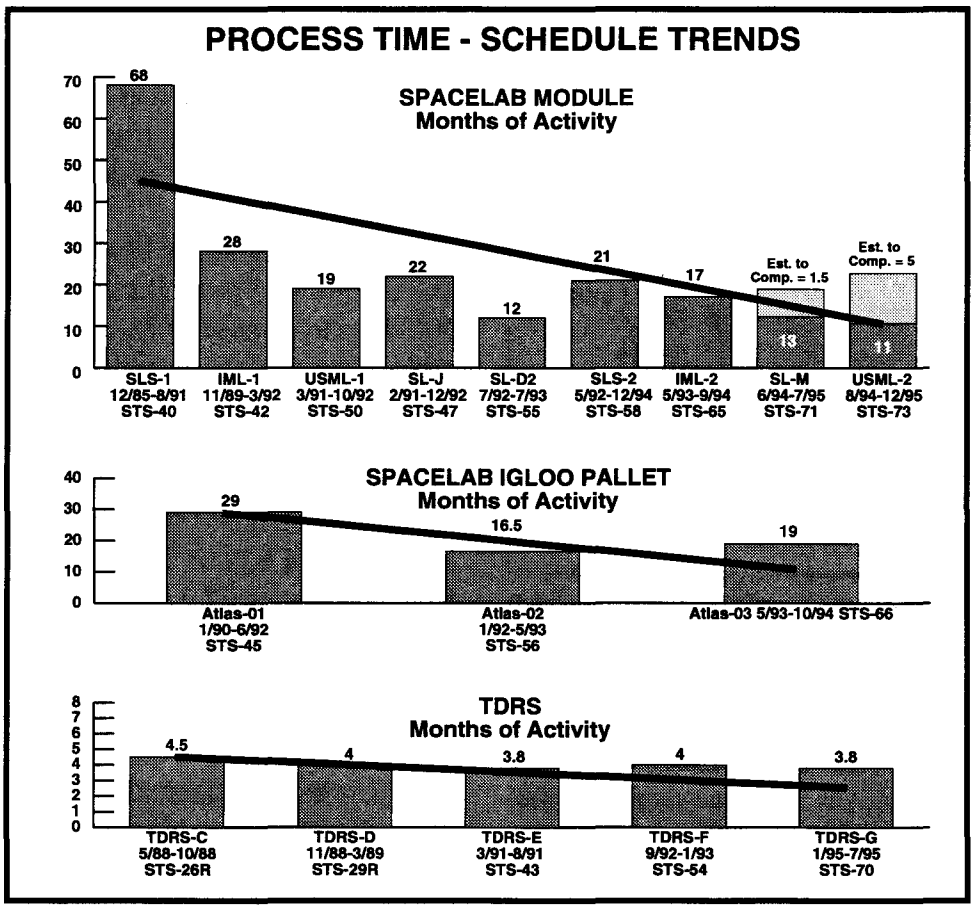


Figure 6.2.11–Payload schedule trends continue to improve

have claimed rebates from the local power company since November 1993 totaling to just over $400,000 for our energy saving initiatives as shown in Figure 6.2.17. Fifty percent of these rebates are available for us to reinvest in other energy and water saving projects.

According to recent data as shown in Figure 6.2.18, we are the most energy efficient center of the four NASA Space Centers: Kennedy, Johnson, Marshall, and Stennis. Our performance metric for this comparison is facility energy consumed per gross area.

Another conservation success story is our environmental resource management. Hazardous waste minimization cost avoidance for FY94 was $2.3 million, a 3,000-percent increase from FY91 as shown in Figure 6.2.19. Of the $2.3 million, over $2.0 million of the savings resulted from no-cost implementation efforts. In FY95, the projected cost avoidance is expected to be $3.7 million.

Our hazardous waste minimization six-year plan is provided in Figure 6.2.20. KSC is on track to meet or exceed the 80-percent reduction target by FY97. Since its inception in 1991, we have reduced our hazardous waste in Shuttle processing by 60 percent.

Another area showing responsible environmental stewardship at KSC deals with air quality. Recognizing that there was a Federal as well as global need to eliminate the use of ozone- depleting substances, KSC set a goal in 1990 to substantially eliminate their use in Shuttle processing activities and in facility and support equipment. Through a concerted effort of multiple KSC organizations, the use of ozone- depleting substance at the Center has dropped by 60 percent over the past

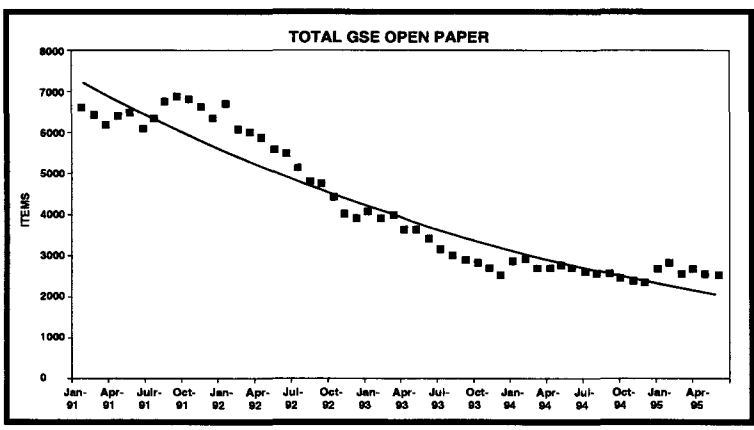


Figure 6.2.12 — Reductions in GSE open paper

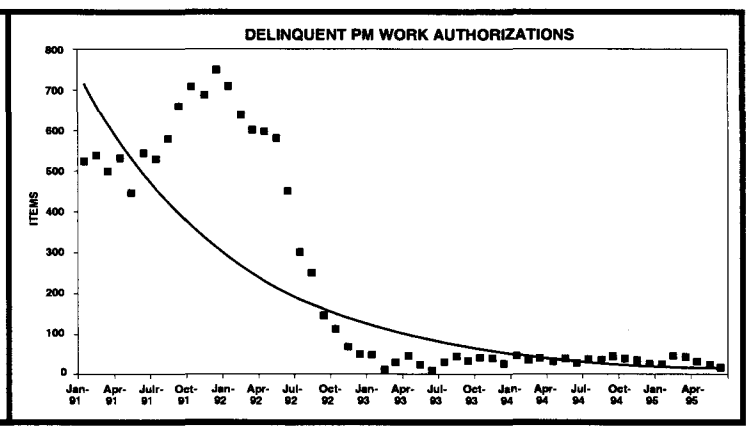


Figure 6.2.13 — Reduction in GSE maintenance backlog

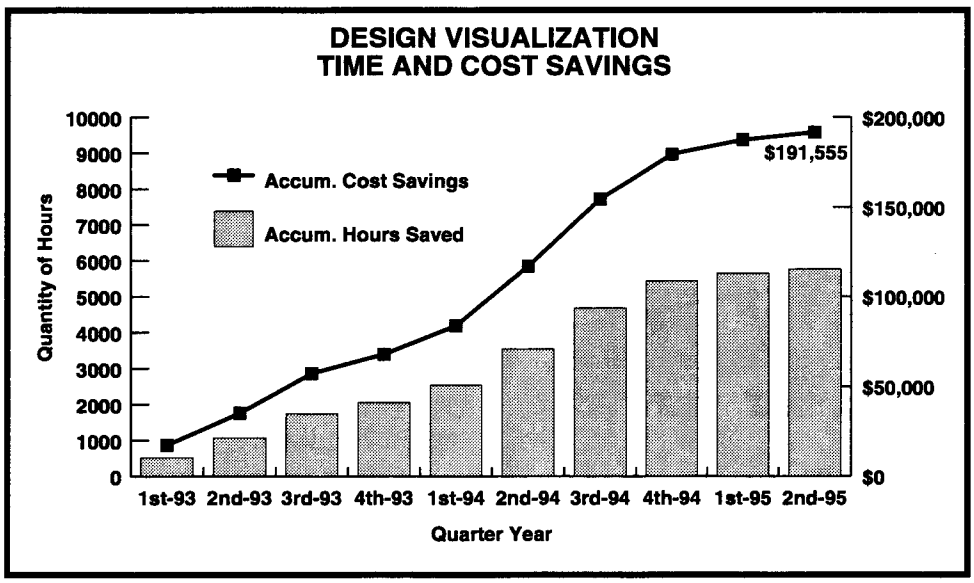


Figure 6.2.14 — Design visualization saves time and dollars by doing it right the first time

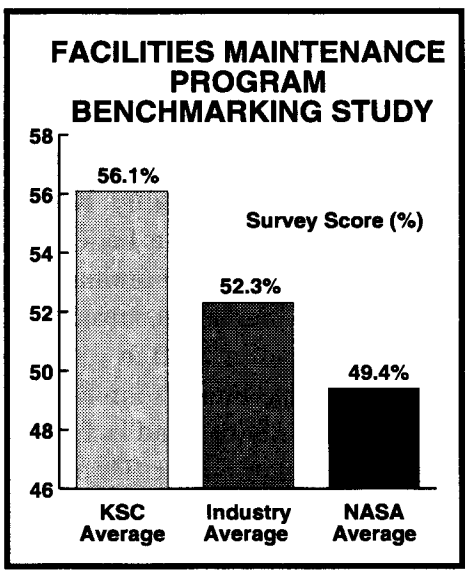


Figure 6.2.15 — The 1995 facility maintenance benchmarking survey shows KSC is considerably better than the NASA and industry average

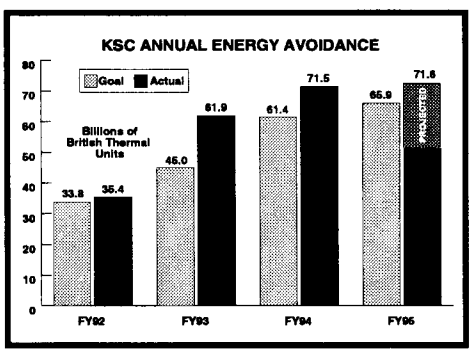


Figure 6.2.16 — Energy consumption avoidance continues to improve

six years as indicated in Figure 6.2.21. The cost avoided by finding alternatives for ozone-depleting substances has also been significant. Nearly $1 million will be saved for CFC-113 solvent use by employing aqueous cleaning methodologies.

Many of the processes used to reduce the consumption of these substances were developed at KSC and are currently being transferred throughout NASA and to other government agencies.

At the beginning of 1994, KSC's excess property program took over 300 days to dispose of excess property. The standard established by NASA Headquarters was 210 days. The results of the CI team who took on the task to reduce our disposal time to the standard are shown below in Figure 6.2.22. The reduction from 300 days to 67 days has helped to acclaim KSC as one of the Agency's best and has prompted others to benchmark against our process.

There has been increased emphasis on the KSC records management and in reducing the growth of the total storage volume of 63,000 cubic feet of technical records. Improv-

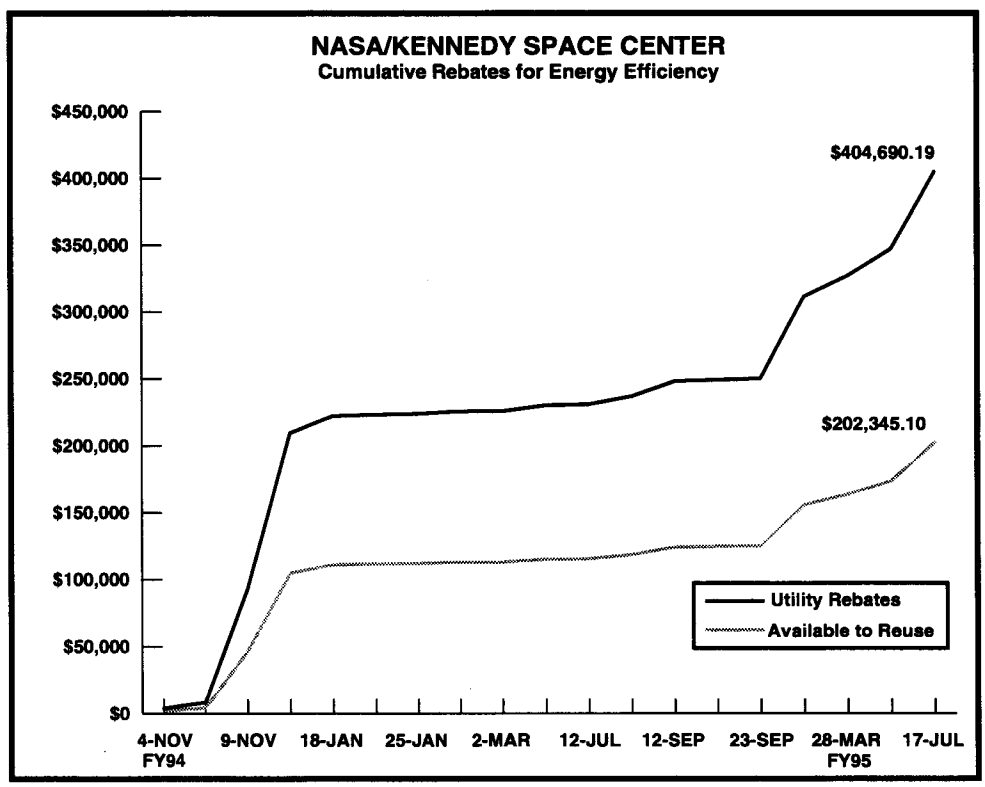


Figure 6.2.17 — Energy rebates from Florida Power and Light

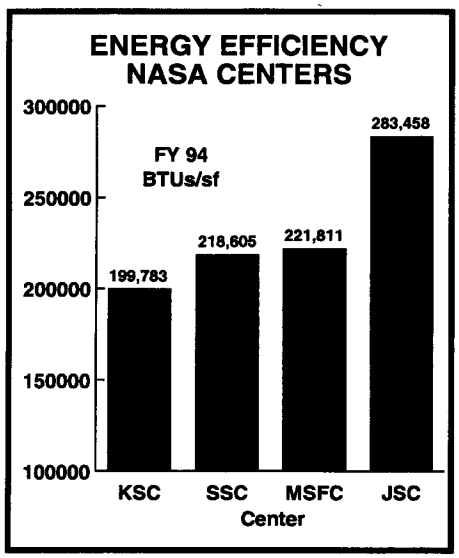


Figure 6.2.18 — KSC leads the Agency in energy efficiency accomplishments

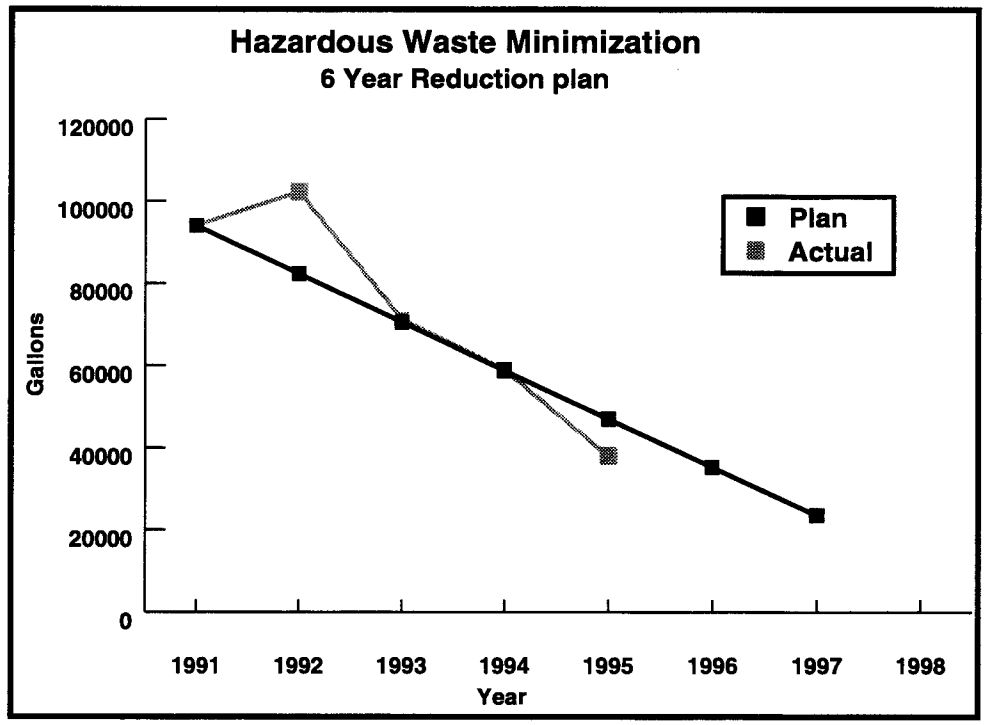


Figure 6.2.20 — KSC's hazardous waste minimization goal is challenging but attainable

ing our processes has decreased the high accumulation rate of technical records from 2,000 cubic feet per month in 1992 to less than 550 cubic feet per month in 1994. Figure 6.2.23 shows the results of the CI reduction efforts decreasing the growth by 73 percent. A re-engineering effort is underway to implement electronic storage capabilities to significantly reduce the overall storage volume.

Quality initiatives recently undertaken in our procurement office, as discussed in Section 5.3.c, have had the following results. The electronic formats developed to distribute solicitations on the Internet, as a part of our mid-dollar range initiative, have reduced the number of pages in a solicitation from an average of 75 pages to 10. Distributing a synopsis on the Internet allows for immediate retrieval by offerors, eliminating two to four days of mail time. Also, under this initiative, the synopsis and the solicitation are publicized on the Internet simultaneously rather than sequentially, and the solicitation waiting period has been reduced to 15 days. This new process results in an overall savings of 30 days in procurement lead-time.

The use of credit cards makes the procurement process even more responsive to both internal and external customers. Both time and paper are significantly reduced through their use. Procurement lead time is reduced by as many as 43 days. Making a verbal order rather than using a written purchase order reduces the number of sheets of paper from 97 to 7 for each order. Using credit cards, technical personnel may now drive down to the local hardware or electronics store to pick up a replace-

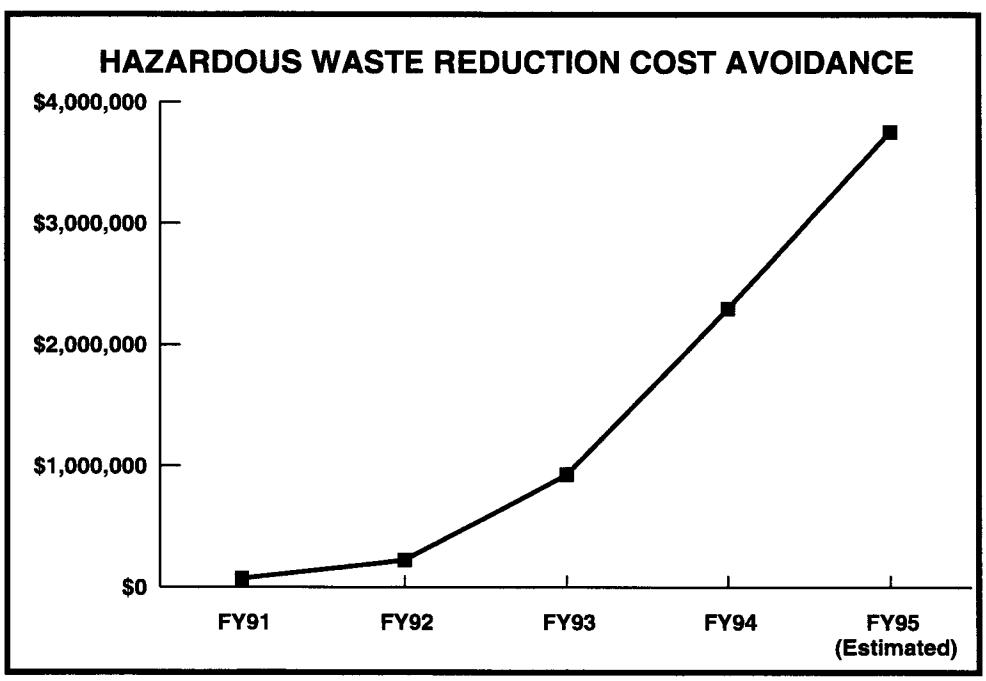


Figure 6.2.19 — KSC saves millions by an outstanding hazardous waste reduction program

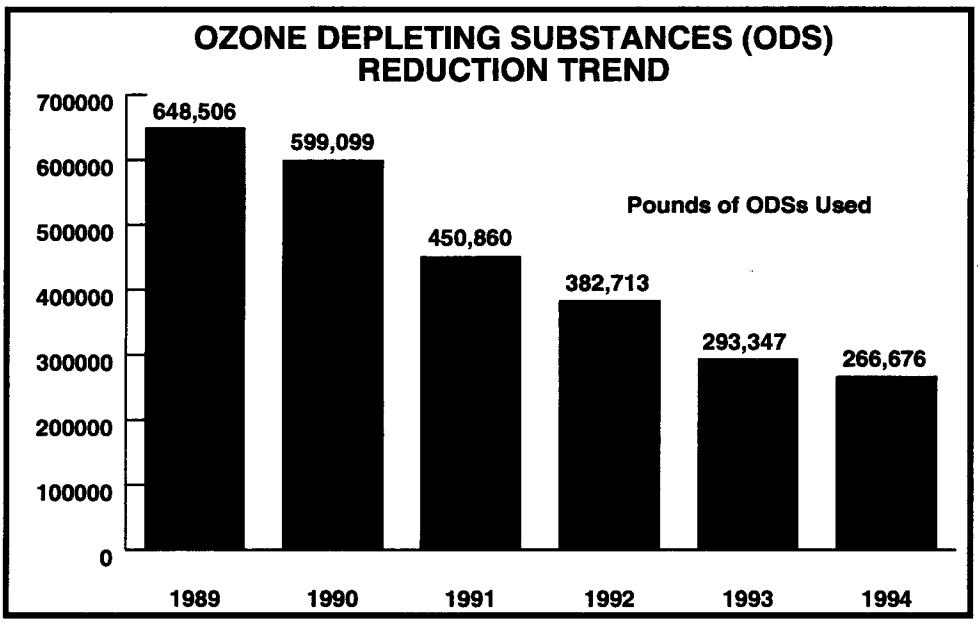


Figure 6.2.21 — KSC reductions in the use of ozone depleting substances since 1989

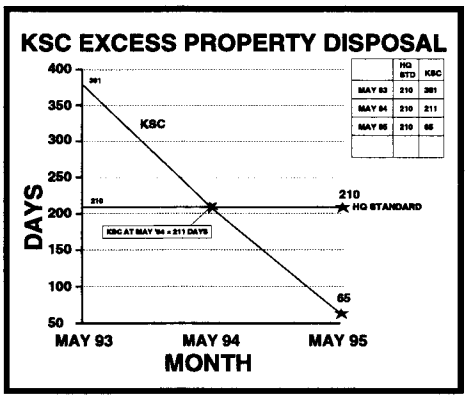


Figure 6.2.22 — CI Team reduced excess property disposal time

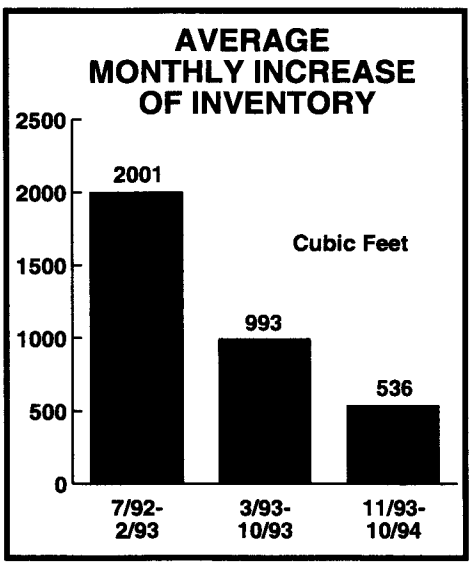


Figure 6.2.23 — Technical records growth continues to decline

ment part they need and have it immediately.

6.3 Supplier Performance Results

Our prime contractors serve as the major suppliers to accomplish our mission. In evaluating supplier effectiveness, we focus on performance as measured by the award fee process. The award fee process encompasses technical, cost, resource management, safety, and quality factors. Historical data and trends for three of our primes are provided in Figure 6.3.1. Current data shows performance improvement even while contractor downsizing has occurred; this downsizing is not related to a reduction in contract scope but rather continual improvement efforts that have resulted in efficiencies. Additionally, contracts have been established that include an incentive feature as well as the award feature, to allow the contractor to share in cost savings realized from process improvements.

The award fee cycle allows KSC civil servants and contractors a formal opportunity to provide contract

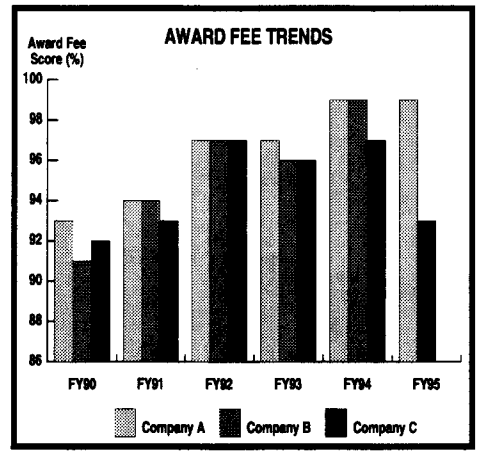


Figure 6.3.1 — Award fee trends of our contractors show steady improvement over time

performance feedback. The contractor is afforded the opportunity to assess the validity of the evaluation, providing data as necessary to substantiate or refute specific areas. Weaknesses identified are transmitted to the contractor as areas of emphasis for the next contract period. This interaction allows the supplier an opportunity to negotiate the measures to assess how weaknesses are considered corrected. Periodic meetings are conducted between the suppliers and the contract managers to gauge progress.

Small disadvantaged businesses play a key role at Kennedy Space Center as discussed in Section 5.3.c., and we track and monitor our use of small disadvantaged businesses very carefully. NASA Headquarters sets goals for each center to award specific amounts of prime and subcontract dollars to small business, small disadvantaged businesses, and women-owned small businesses. In FY93 and FY94, we exceeded that goal as reflected in Figure 6.3.2.

Logistics' key performance metric is on-time supportability, which is monitored continually and represented as the percentage of time that

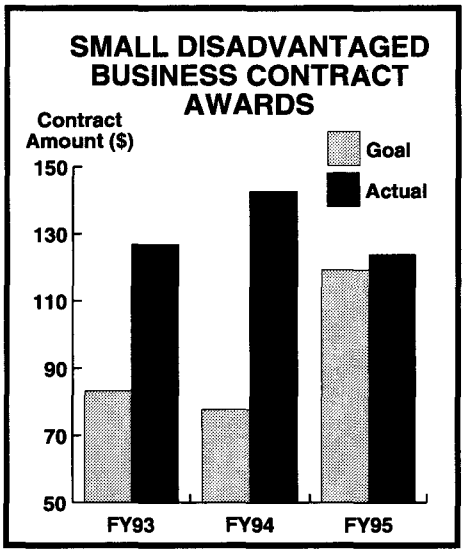


Figure 6.3.2 — We have exceeded our SDB goals in each of the last three years

parts/material demands are filled on or before the specified need date to support orbiter processing. The average monthly supportability rate over the last twelve months has been 99.5 percent as shown in Figure 6.3.3.

The logistics support effectiveness of our payload operations is managed by using continuous inventory analysis and examination of tasks delayed due to part shortage. Since 1991, we have increased the logistics fill rate effectiveness from 91 percent to 97 percent as shown in Figure 6.3.4. Through a combination of customer feedback, inventory analysis, and line-item management, we are exceeding our payload support strategic goals.

Another comparative measure resulting from our transition to structured surveillance is first-time quality. Since the surveillance audits have been implemented, the products and services coming from our prime contractors have consistently met or exceeded quality requirements over 98 percent of the time. Figure 6.3.5 provides the first-time quality measures.

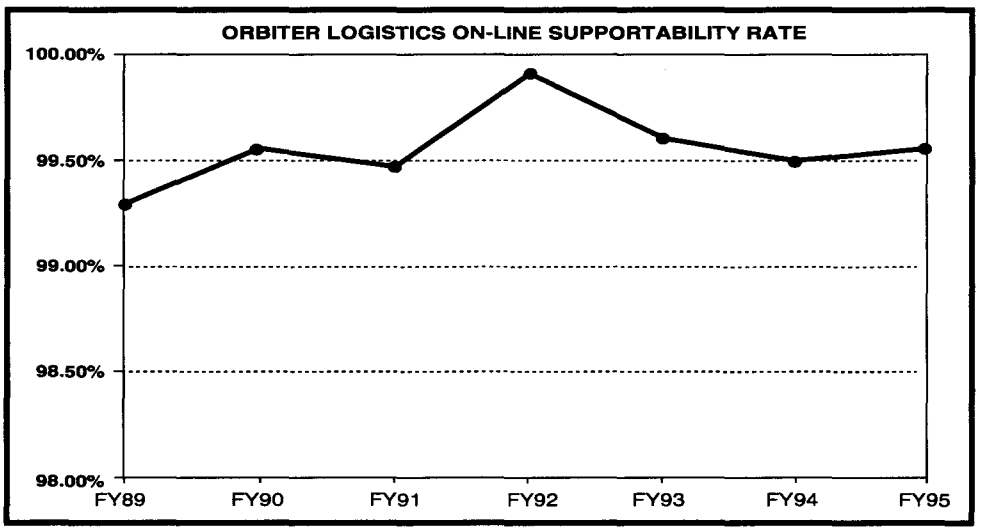


Figure 6.3.3 — Orbiter logistics support

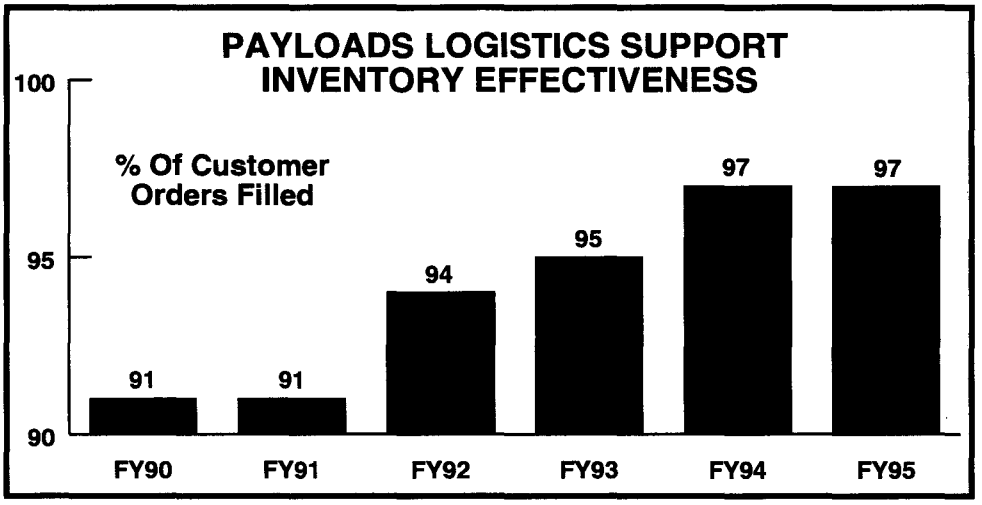


Figure 6.3.4 — Payload support inventory effectiveness

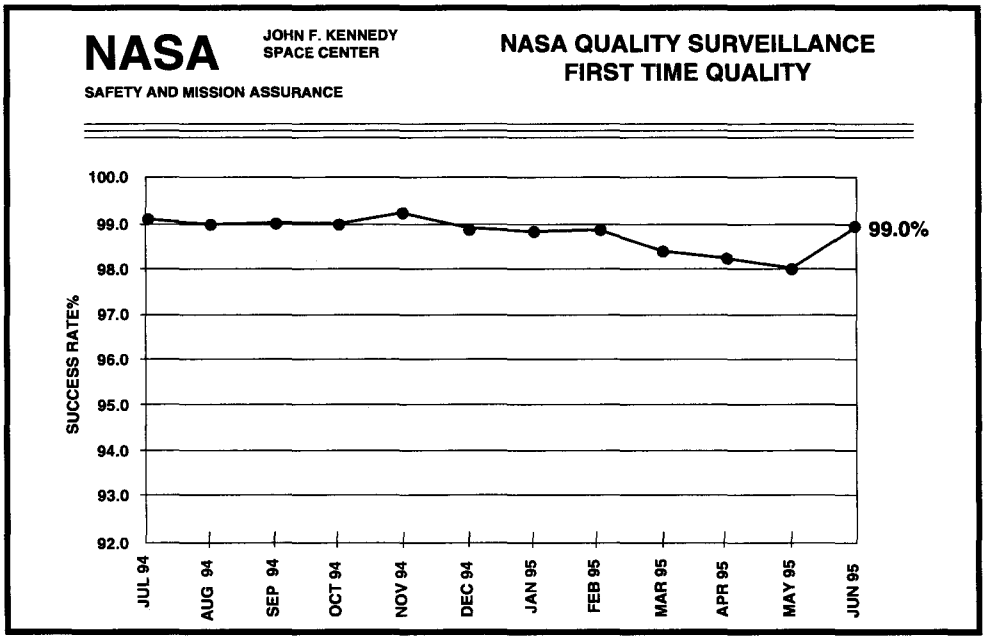


Figure 6.3.5 — First Time Quality

7.0 CUSTOMER FOCUS AND SATISFACTION

Our customers at KSC are varied and all have unique requirements. We strive to improve our process, based partially upon their feedback, to ensure we continue to meet their expectations. The challenge of working with all of these groups has been extremely rewarding, especially our foreign partners. This year, we embarked on the first steps of our future space journey with our Russian Space Station partners in this new age of international cooperation. The processing of their docking module in our facilities this summer went extremely well despite language barriers, technical challenges, and our lack of experience in working together. Their high levels of satisfaction with our service are additional proof that our support is "world class."

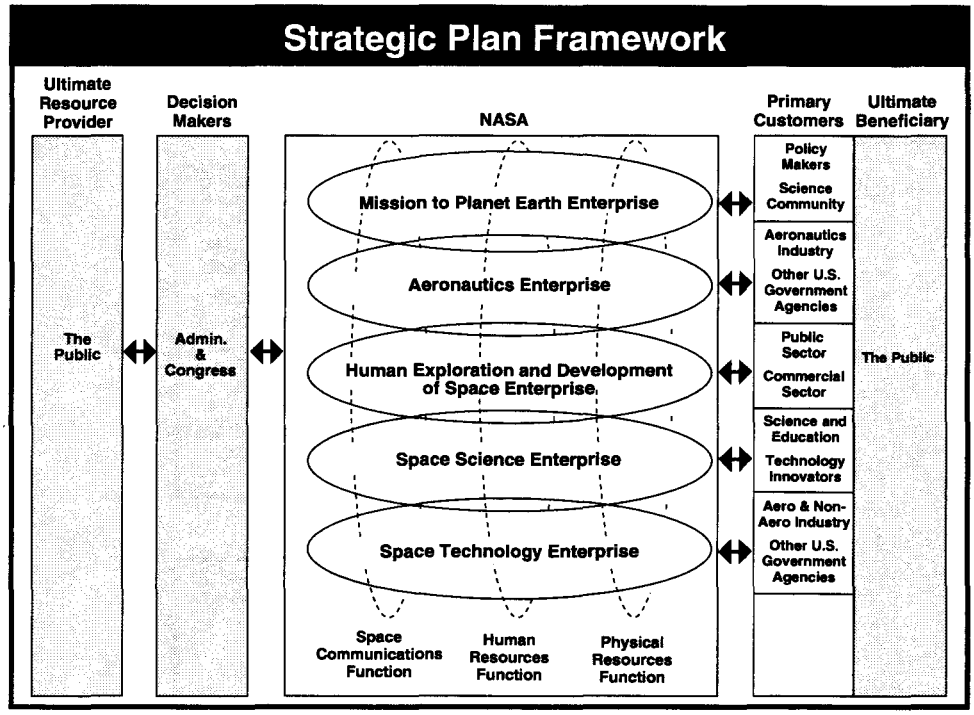


Figure 7.1.a.1 — NASA Strategic Plan Framework defines our customer base

7.1 Customer Knowledge

The National Aeronautics and Space Act of 1958 directs NASA to conduct space activities devoted to peaceful purposes for the benefit of all mankind, thus defining NASA's ultimate customer group. We have explicitly defined our customer base and our dedication to customer satisfaction in the NASA Strategic Plan and KSC Strategic Plan discussed in Section 2.0.

7.1.a

The quality of customer support provided by KSC is driven in part by external requirements defined by law or regulation. The Administration, Congress, and NASA Headquarters play key roles in defining the KSC work environment in the form of budget guidelines, small business and small disadvantaged business goals, multicultural diversity policies, and other measures. These are communicated through the internal KSC budget process and special communications to the Center and are shared with affected employees through managers' and employees' performance plans, directives, and announcements.

The NASA Strategic Plan, published in February 1995, emphasizes the Agency's commitment to satisfying our external customers and identifies NASA's external customer groups in a conceptual framework as shown in Figure 7.1.a.1.

Each of the NASA customer groups is a KSC customer group to some extent. KSC's principal external customers are illustrated in Figure 7.1.a.2. The needs of our customers are as diverse as the customers themselves, but their expectations are identical - they expect continuous excellence from KSC in all our endeavors.

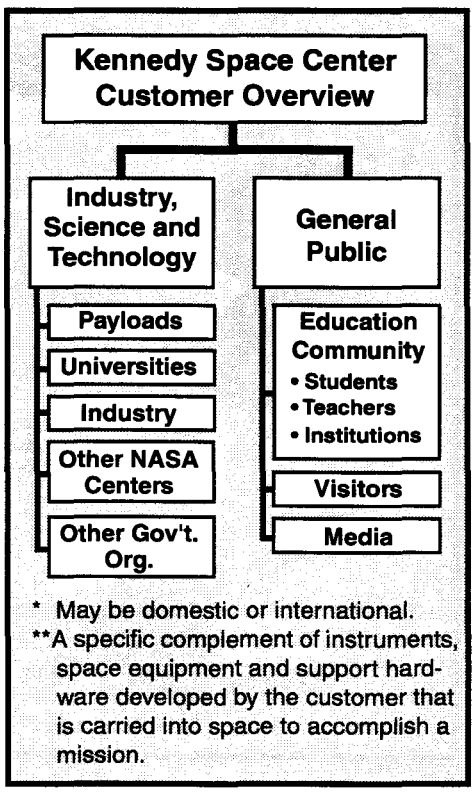


Figure 7.1.a.2 — KSC has many customers

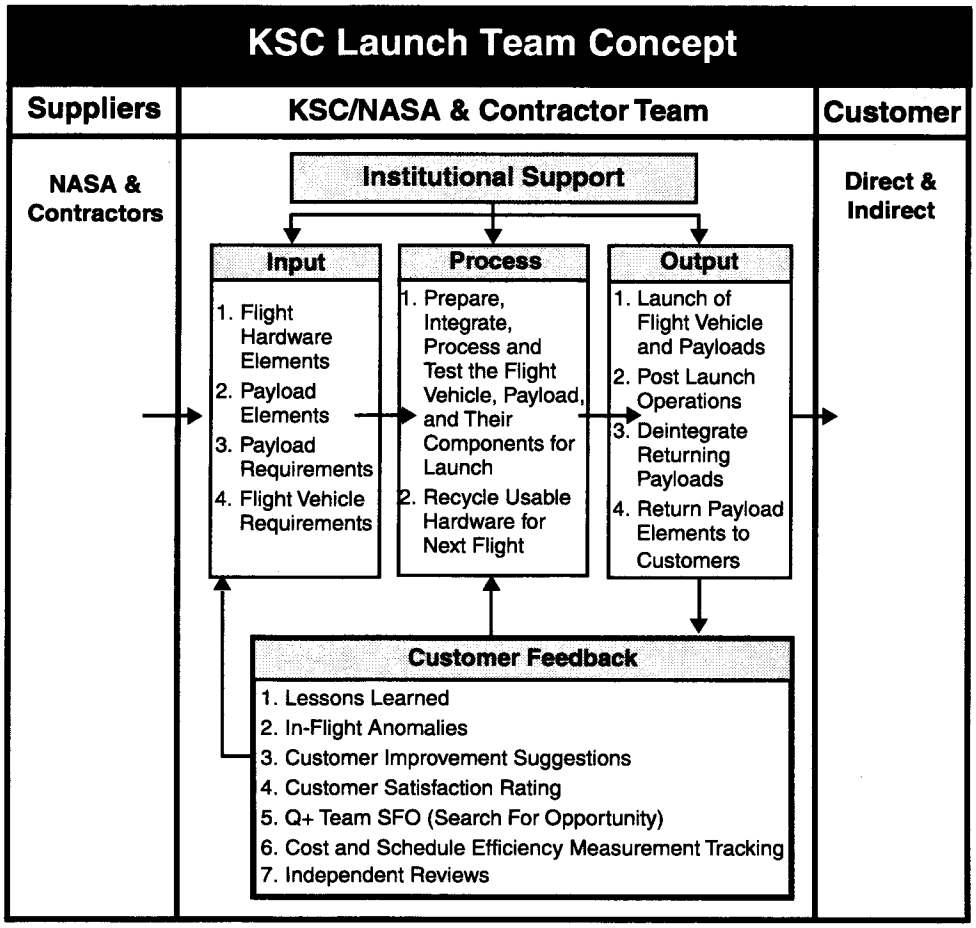


Figure 7.1.a.3 — KSC Launch Team works closely with our customers

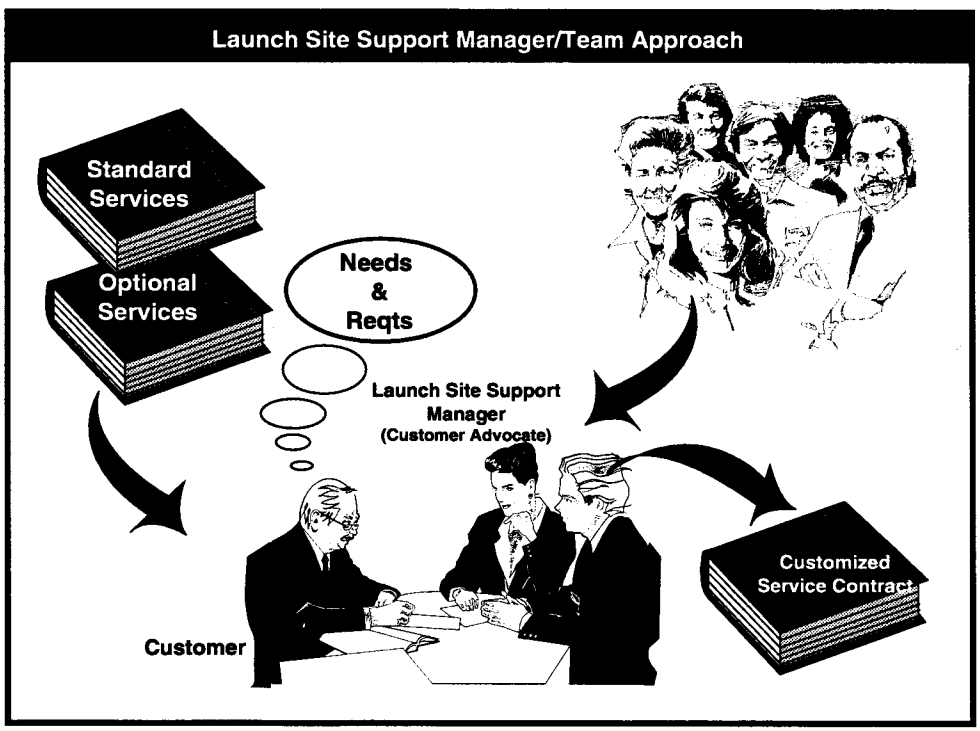


Figure 7.1.a.4 — Launch Site Support ensures all customer requirements are identified and satisfied

With our industry, science, and technology customers, we conduct business with those customers who provide payloads to be launched on the Shuttle. In this section, we include examples that refer to the Shuttle payload process. Examples from other areas are used to demonstrate the variety of customers and satisfaction techniques that are used at KSC.

We gather requirements and initial expectation information from our Shuttle and expendable launch vehicle payload customers through the process illustrated in Figure 7.1.a.3. Our emphasis has been to begin this dialogue as early as possible to provide payload customers the best possible information early in the planning process. This has allowed us to match their expectations to our capabilities, to the maximum extent possible within our budgetary constraints, and to eliminate future misunderstandings.

Our philosophy is that the quality of the process can be enhanced if KSC employees understand the customer's expectations and enter their requirements into the various KSC systems and processes.

The Launch Site Support Team is composed of representatives from all organizations and functions supporting a customer. This provides the level of one-on-one, customer-to-supplier interaction where requirements and expectations are explained directly to the employees who need the customer information and will be performing the work.

Our management approach, shown in Figure 7.1.a.4, is typically used to implement this process.

The launch site support teams work carefully with customer teams, beginning well in advance of their

arrival at KSC. Indeed, in some cases, discussions begin as early as three years ahead of time. There are continuous dialogues and negotiations until the Launch Site Support Plan is signed by both the customer and our personnel to formalize their mutual agreements.

For our customers from local schools and universities, KSC provides opportunities for educational outreach, including special programs for institutions, teachers, and students. Programs at the local level are handled through formal agreements with the Brevard County School Board to determine their needs. We survey our customers after they participate in the educational outreach programs, teacher workshops, and student programs, and use their recommendations to improve subsequent programs. At the university level, specific agreements are established to identify each university's needs and KSC's commitment to meet them.

7.1.b

Future needs of payload customers are defined via our normal processes used to determine customer satisfaction, discussed in Section 7.1.c. Through our survey processes and by including customer personnel in our continuous improvement teams, we have been able to identify numerous improvements to support future customers. In addition to these processes, our managers have played an important role in evaluating future needs. John Conway, Director of Payload Operations, Bobby Bruckner and Bill Fletcher, senior managers of the Launch Site Support Office, routinely hold discussions with customer managers and processing teams. This has been found to be a valuable tool in determining future requirements as well as understanding current customer satisfaction.

7.1.c

We improve our process for determining customer needs and expectations in a variety of ways. Figure 7.1.c.1 shows how we survey customers to identify opportunities for improvement in the requirements-gathering process.

We use applications for the quality awards as an opportunity for a thorough self-examination and to provide an independent third-party assessment of our focus on customer satisfaction. Due to the recognition of KSC's efforts in improving customer satisfaction, our Shuttle and payload processing has been selected as a laboratory for the National Performance Review (NPR) due to the recognition of our efforts in improving customer satisfaction. The NPR requested that a KSC senior manager, JoAnn Morgan, represent NASA as the only Federal technology agency speaker at the first conference on "Putting the Customer First" held in Hunt Valley, Maryland, in December 1993.

7.2 Customer Relationship Management

7.2.a

We have many communication paths to allow customers to seek assistance, solicit their feedback, and identify issues. The most effective and most frequently used route is the ongoing one-on-one communications between the Launch Site Support Team and their customer counterparts. Figure 7.1.a.4 illustrates the process for bringing employees into contact with customers. Members of the Launch Site Support Team have documented standard accommodations and services that are offered to customers. The customer response is a mixture of acceptance of existing standards and requests for different services or standards. Also, management frequently solicits customer feedback, and data is obtained after processing is completed via the Customer Satisfaction Survey.

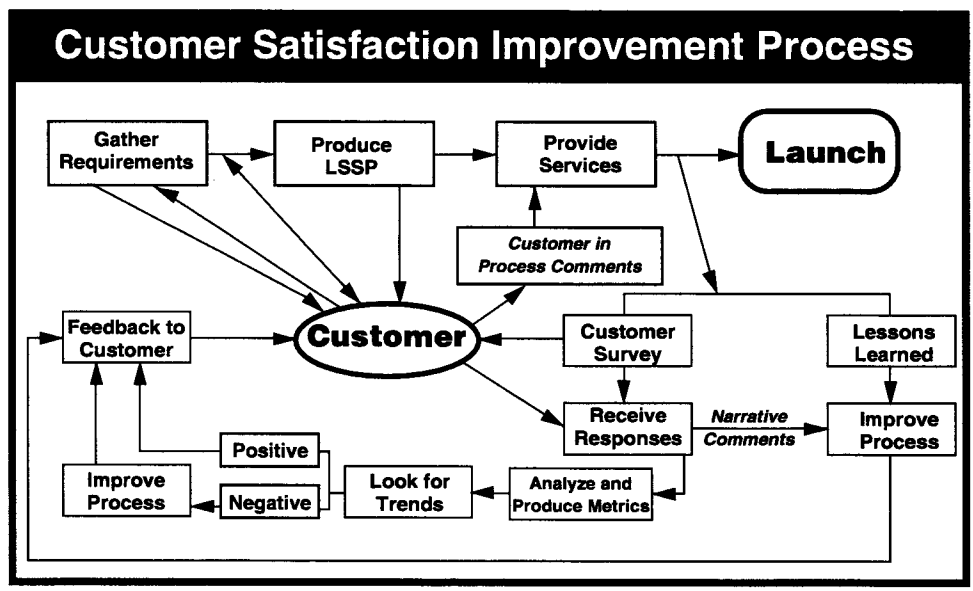


Figure 7.1.c.1— Customer satisfaction improvement process

We have documented our objective and measurable quality indicators, such as providing certain cleanliness levels to assess our performance against the standards provided to the customer. In addition, KSC's chemical analysis laboratories verify the purity of chemicals in consumables provided to the astronaut customer.

Quality indicators can also be subjective, assessing how well the process satisfies the customer. Subjective service standards are described in the Payload Customer Survey. The process allows for quantifiable standards or metrics to be derived from these subjective evaluations.

Other key quality indicators derived from external requirements discussed in Section 7.1.a include customer satisfaction related to costs, contract changes, fair and expeditious contract awards, and contract awards to a diversified business community. Objective service standards, such as facility cleanliness level, are described in facility handbooks and optional service handbooks. These handbooks are reference materials used by Launch Site Support Team members and are provided to customers early in the planning process for their use.

A summary of the three primary standards is given in Figure 7.2.a.1.

These summary standards are based on an aggregation of key individual standards that encompass the entire process. Any particular item must be rated as 4.0 or above to meet the minimal accepted service standard level. Results of surveys are distributed to management and to employees who are part of the process. An interpretation of the latest scores is included in Section 7.4.

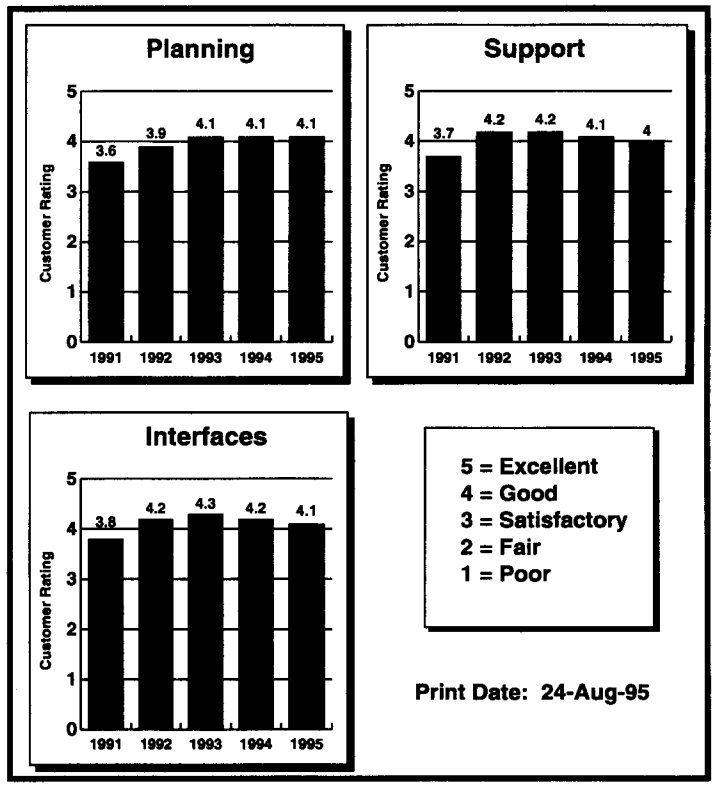


Figure 7.2.a.1 — Aggregated Customer Ratings demonstrate customer satisfaction

A forum often used for communicating expectations and standards is the contract award fee process. This is particularly effective when standards change or when the customer expresses that some improvement is necessary. Results are tracked by event and time and reviewed with affected managers and the Center Director quarterly. Revisions are made based on customer narrative comments, required changes to the process, or increased customer expectations.

7.2.b

As described in the subsequent section, we solicit customer feedback at every opportunity. Formal complaints about current service levels or suggestions for the future are documented and tracked two ways. First, suggestions that are multidisciplinary in nature are dispositioned through our continuous improvement process and their status is tracked by our Q+ team. In many of these cases, customer personnel have participated in our corrective action teams. Simpler suggestions are more appropriately handled through our line organizations. In this case, line management and the customer support office track their dispositions. Figure 7.2.b.1 shows the current disposition of all Space Shuttle customer actions. Because of the innovative design of our database, we can sort customer comments by many different attributes, such as by the NASA center sponsoring the Payload, by the type of payload, or by the type of comments received. Analyses such as these allow us to quickly identify the areas of greatest concern to our customers.

In order to emphasize the customer focus of the Logistics Operations Directorate, a Customer Service Branch was established to provide a readily identifiable interface

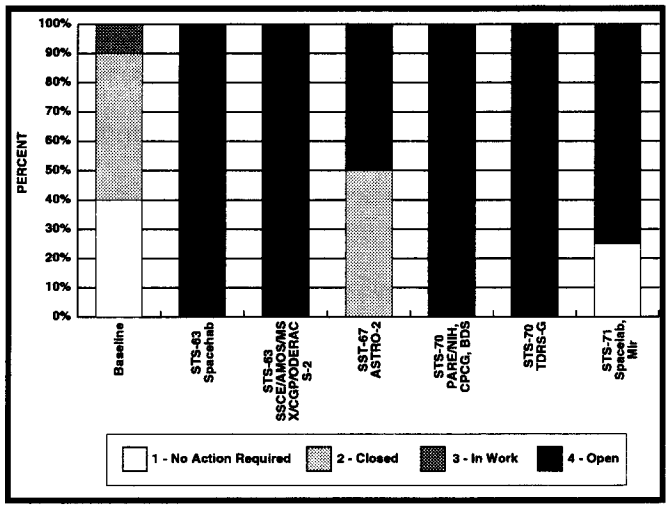


Figure 7.2.b.1 — Space Shuttle Customer actions are tracked to ensure they are addressed

point for all logistics customers. Individuals within the branch are assigned specific customers with whom they communicate at least daily to ensure customer satisfaction. This regular communication promotes timely resolution of logistics concerns and provides valuable feedback utilized to gauge logistics performance.

In addition, we have established customer satisfaction metrics to identify trends and to promote increased efficiencies. An example is the Material Service Centers (MSC's), which have worked diligently to streamline operations and improve customer support. The Shop Floor Data Collection system has been integrated into MSC operations to identify Shuttle processing delays attributed to open logistics requirements. The data indicates that the support rate for scheduled tasks has been consistently above 97 percent. We have also initiated "voice of the customer surveys." Customers were able to rate the MSC's in areas such as timely service, courteous and professional service, timely receipt of material, receipt of the correct material/tools, and availability of the requested item.

7.2.c

Payload customers can use the Launch Site Support Team or any individual member to request assistance, verify schedules, compliment KSC on how well requirements are being met, or make recommendations for improvement during the course of the process. The effectiveness of the team has been enhanced by providing customers electronic access to standard sets of information through the Internet/World Wide Web.

After completion of the process flow, there are lessons-learned sessions and customer surveys that measure satisfaction. The customer is not limited to the standard questions but can comment on any part of the process at KSC. Concerns or complaints are assigned as action items to the individual or organization responsible for the area of concern. Action items are tracked by management to ensure a timely and responsive closure. In this way, the customer has access both to the service provider and to process managers for any concern or complaint.

During processing flows, customers may also offer process improvement suggestions to our CI teams or may even become part of a team to resolve process issues. Of particular note, two CI teams (payload safety and security) included customers in their team processes, resolving complaints and improving customer relations. As a result of the teams' activities, review of hazardous procedures improved 60 percent. Security access problems are no longer a concern, and we continue to search for ways to improve the security process for our customers.

Feedback from the customer is solicited before, during, and after the actual payload operations at KSC. The Launch Site Support Team, through a series of design reviews, ground operations working groups, technical interchange meetings, and test team meetings, encourages real-time feedback from the customer to ensure our understanding of requirements and the customers' understanding of products and services provided.

Lessons-learned sessions are held with the customer after significant test events. The customer and other test team members are encouraged to be candid because lessons learned will be applied to later test events for the benefit of all customers. After these sessions, the information is entered into a database that is shared with the entire customer community to enhance future planning activities.

In Public Affairs, a team was formed to review and improve the process of development, distribution, and utilization of launch and landing credentials. The team, composed of process stakeholders from the Public Affairs and Security Offices, identified customers of the processes, allowing them the opportunity to define issues the team would

address. Three surveys were administered and responses were analyzed. All suggestions were considered and many were implemented. The team recommended reducing the various credentials required for Center access by approximately 50 percent, with an anticipated savings in printing and labor, increased efficiency of access through security checkpoints, reduction of guard orders, improved traffic flow, and the elimination of customer confusion.

KSC Customer Survey Process

- Provide Survey Questionnaires to Customers After Launch and Landing Activities are Complete
- Data From the Survey Responses, Both Numerical and Narrative, are Reviewed. Customer Comments Get Special Attention
- Assign Actions to Natural Work Groups to Provide Solutions for Improvement
- Submit Repetitive Customer Complaints to the Q+ Team for Disposition
- Various Work Groups Implement Improvements
- The Customer Survey Team Generates Feedback Reports for Customers and KSC Managers and Employees
- Discuss Survey Results in Management Forums at KSC and With Other NASA Centers

Figure 7.2.d.1 — Our Customer Survey Process ensures we pay attention to our customers

7.2.d

Key elements of the payloads customer survey process, which now has more than three years of data, are illustrated in Figure 7.2.d.1.

As mentioned in section 7.2.c, lessons learned are included in the experience base and are used to improve future Shuttle and payload processing operations. The customer survey has 28 separate areas in which customers are asked to rate the KSC team. These 28 areas are aggregated into the three key areas shown in Figure 7.2.a.1. These three areas are combined into an overall satisfaction index that can be used to compare KSC to other organizations. The results are maintained in a database that can be aggregated over a specific time period (e.g., yearly increments for trending) by type of payload or by other parameter of interest. Any particular item must be rated as 4.0 or above to meet the minimal accepted service standard level. Results of surveys are distributed to customers, management, and employees who are part of the process.

Although aggregates are usually displayed as yearly averages to gauge the degree of improvement over time, searches over particular parameters are also done if complaints appear to have a pattern. Indices that have demonstrated repeatable scores lower than the standard are treated formally like a complaint or a problem. Once a complaint or problem is identified, an owner is assigned. An owner can be an individual, an improvement team, or even an organization. The owner is responsible for developing a response to the customer, and management maintains a log of open complaints and status until the owner responds. These data are trended as illustrated in Figure 7.2.b.1. Figures 7.2.d.2, 3, 4, and 5 provide examples of improvements undertaken as a result of customer concerns.

To improve customer relationships and to assess satisfaction with Public Affairs services of our customers in the general public, managers in each branch survey and interview customers on a regular basis. For example, the Media Services manager conducts telephone surveys of customers, such as NBC, ABC, and CBS news personnel, Florida Today Newspaper, Orlando Sentinel, the three wire-services, and wire-service photographers, to assess satisfaction with KSC services and to solicit suggested areas for improvements. In addition, Protocol and Special Events management interviews and surveys internal and external customers, such as Lockheed Martin, Rockwell, Spaceport Florida Authority, Cocoa Beach Chamber of Commerce, and the Patrick Air Force Base Protocol Office, to assess staff performance, accessibility, products, and services.

7.3 Customer Satisfaction Determination

7.3.a

KSC has long-term commitments to a variety of domestic and international customers. These commitments are documented in Launch Site Support Plans, which are developed for each payload processed at KSC.

The Launch Site Support Team is responsible for developing the Launch Site Support Plan, which describes our products, services, and relationships to the customer. The plan is the result of iterative dialogue between KSC and the customer.

We also have formal change procedures that allow the customer to modify requirements in a controlled fashion once the plan is baselined. To facilitate processing, KSC has also developed an informal process for customers with simple requirements.

Understanding and Documenting Customer Requirements
Problem: Concern About KSC's Depth of Understanding and Documentation of Payload Customer Requirements
Solution: Early and Formal Presentation Highlighting Unique Payload Requirements. Expand KSC In-House Review Team. Launch Site Support Manager and Engineer Provide Consolidated Review Comments to Payload Customer
Results: Identified 13 Key Improvement Areas to Better Define and Document Payload Customer Needs and Expectations. Now 12 Out of 13 Areas Meet or Exceed Our Satisfaction Threshold

Figure 7.2.d.2 — Customer Requirements

Support to Payloads at the Launch Pad and Orbiter Processing Facility
Problem: Payload Customer Understanding and Knowledge of Support Function Requirements (e.g., Safety, Scheduling)
Solution: Improved Payload Customer Training Regarding Safety Organizations Involvement in Payload Customer Operations at the Pad. Defined critical path tasks and resource limitations. Developed Measure to Indicate Schedule Performance
Results: Smoother and More Efficient Operations for Payload Customer at OPF. Customer Satisfaction Ratings Improved From 68% to 90%

Figure 7.2.d.3 — Support to Payloads

Improved Scheduling System
Problem: Scheduling System Too Rigid and Insensitive to Payload Customer. Also, Communication Breakdowns Were Occurring, Causing Schedule Impacts
Solution: Improved Training of Payload Customer and How Schedule Decisions are Made at KSC. Modified Scheduling Procedures to be More Flexible and Interactive
Results: Increased Percentage of Jobs Worked as Scheduled. Customer Satisfaction Ratings Improved From 62% to 78%

Figure 7.2.d.4 — Improved Scheduling

Customer Access to KSC Payload Processing Facilities
Problem: Payload Customer was Concerned About Length of Time it Took to Obtain Appropriate Badging for Processing Facilities
Solution: Modified Software and Communications to Complete Prebadging Activities Earlier in Process. Improved Security Briefings and Training of Payload Customer
Results: Improved Customer Satisfaction, From 68% to 80% in the Timeliness of the Badging Process

Figure 7.2.d.5— Customer Payload Access

If a customer's requirement exceeds our current standards or services normally offered, discussions are conducted with the customer to negotiate a solution. For example, the facility cleanliness requirements for the Hubble Space Telescope were more stringent than our standards and services provided. KSC took extraordinary steps to meet the customer's requirement. Communication with the customer occurs at several different levels before, during, and after processing at KSC. A customer's level of satisfaction can be obtained from the customer's response at planning sessions and test team meetings held at the customer's site, at KSC, or teleconferences. During the payload processing flow, the customer communicates his needs to the working level employees. Managers regularly check with customers to assess customer satisfaction and are readily available if the customer has a concern that cannot be satisfied at the working level.

Our survey process, discussed in the previous sections, also provides a measure of customer satisfaction. Administered by an objective group in the organization, each customer payload team is surveyed after each launch. (A launch may include multiple payloads, each with multiple team members.) The survey requests that the customer rate each applicable item in the survey on a scale of 1 (poor) to 5 (excellent). Any score below 4.0 becomes a priority candidate for improvement. The customer can also make narrative comments in the survey. Typical results are shown in Figure 7.2.a.1.

7.3.b

Because of the nature and uniqueness of payload processing, it is difficult to collect customer satisfaction data that directly compares KSC with other organizations at the overall organizational level. However, KSC regularly collects customer satisfaction data at the process or function level and, to the extent possible, makes comparisons. There are some indirect and anecdotal comparison examples that are relevant. For one group of customers, our major support is the provision of facilities and services. Our metrics indicate that our facilities and services have always been available on schedule and have never delayed a customer's launch, even though some customers have required some extremely stringent standards for cleanliness, temperature, and humidity levels. A customer's mission has never been compromised or a customer's equipment damaged because we violated these require-

ments. There is data from other service providers to compare this performance directly.

A recent analysis by an independent firm sponsored by NASA Headquarters demonstrated that our facility maintenance program was rated significantly higher than the national average and that we are among the leaders in implementing new maintenance technologies.

Recently, we hosted Russian and European customers who also have used other launch services, and they have been complimentary of the accommodations and services provided. The Europeans arrived just 12 hours before Hurricane Erin hit the area. They were delighted by the dedication of our people who were able to offload $1.5 billion worth of equipment from their airplane in eight truck loads and secure it all from hurricane damage in a short period of time under already adverse weather conditions.

Finally, we were requested by another customer to arrange for facilities and services at our West Coast launch facility. With the customers approval, we secured appropriate support from commercial providers. It was a vote of confidence by our customers that they asked us to negotiate the services, rather than negotiating directly with the commercial provider.

7.3.c

We update and improve our customer survey by analyzing response rates to particular questions, by comments from the customers about their understanding of the survey questions, and by looking for patterns in the narrative responses over several payloads. Survey questions are sometimes expanded to address areas of concern that past customers have identified. As a minimum, the survey instrument is modified annually.

As mentioned earlier, we concentrated on the perceived major problem areas during the first few years and achieved a measure of success and improvement. These problem areas were identified because they had "low" scores or because multiple customers made similar comments. The past could be generally characterized as the time when we took pride in compliments and fixed problems as fast as possible. We are now in the era when we are striving to make excellent performance even better. We still take pride in compliments paid, and we take every customer comment and complaint as an opportunity for improvement. Each customer comment is addressed individually. When possible, the customer is informed of the proposed improvement, and feedback is solicited. In the past, some comments may not have been resolved for up to a year after launch. Our goal now is to resolve all comments within 30 days of their receipt.

7.4 Customer Satisfaction Results

7.4.a

Multiyear trend data on external customer satisfaction is shown in Figures 7.4.a.1, 2, and 3.

The obvious improvement from the 1988 to 1991 timeframe to the 1994 data demonstrates the value of customer feedback and our commitment to improving the satisfaction of our customers. The individual elements also show where further opportunities for improvement are necessary or possible. The overall summary shown in Figure 7.4.a.4 provides a general customer satisfaction trend index and helps to compare our level of customer satisfaction to other organizations.

As can be seen from the data, our performance appears to have leveled over the past two years. While this is disturbing, we have determined that a number of factors have caused this trend. During the first few years, we concentrated on those issues that drew the most frequent customer comments. Now we are carefully studying individual customer comments in order to effect smaller, but important, incremental improvements in our processes. We have no-

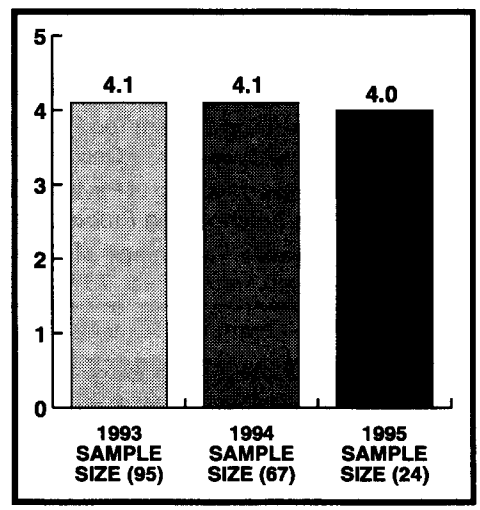


Figure 7.4.a.1 — Planning and Preparation Functions exceed expectations

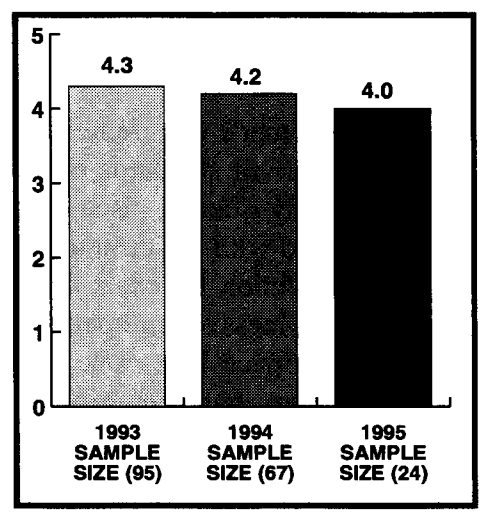


Figure 7.4.a.2 — Functional Key Interfaces exceed expectations

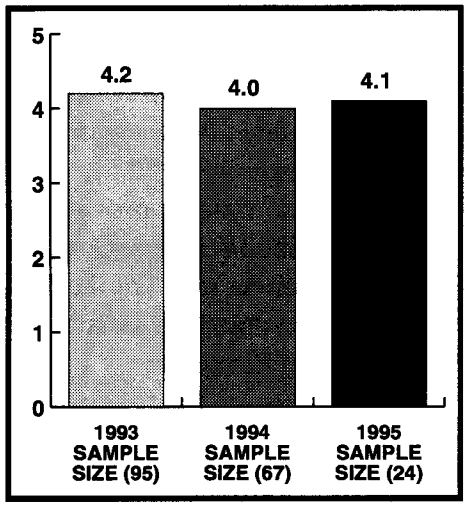


Figure 7.4.a.3 — Processing Flow Support has exceeded all customer needs

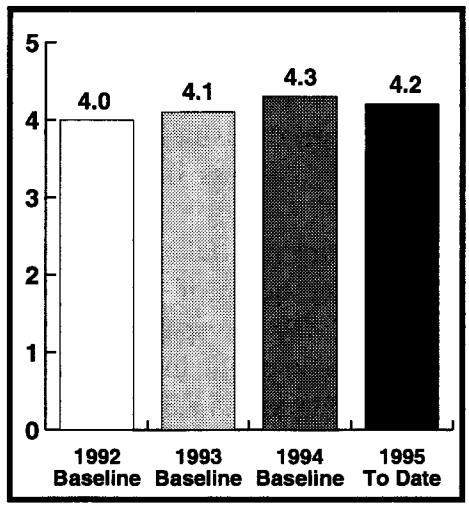


Figure 7.4.a.4 — We continue to improve customer satisfaction

ticed that the way we counted survey responses may be skewing the results. In the past, we observed that some customers would "consolidate" comments and return one survey representing multiple individuals. This was counted as one response. This year, one customer submitted many survey responses, and each response was counted as one. Upon detailed examination of the responses, we discovered that there were multiple responses about the same event. The problem was real and was corrected, but the calculus of the survey results analysis probably gave too great a weight to that one issue, driving overall scores down. As long as we were getting positive comments, we overlooked this aberration in the survey analysis technique. We will be revising the scoring routine to ensure our analyses clearly indicate where our customers perceive our problems to be and which are the most important to address relative to each other. However, our focus is still on the individual customer's comments. We believe that our performance has leveled because our customer expectations have increased. As our performance increased, our customers have come to expect even more from us and have been more "critical" in their survey responses. We view this as a positive trend because our customers recognize our commitment to improving customer service and have become increasingly forthcoming with suggestions for improvement. Despite all of this, our goal continues to be to receive "5's" in every category, every time.

7.4.b

Throughout Section 7, we have used measures, metrics, and displays of customer satisfaction and dissatisfaction. We have also touched on the fact that the measures are dynamic because we find new ways to analyze the data and because customer expectations change. In a sense, all the measures are key because we cannot ignore any messages the customers might be sending. By reviewing trends across time and customer types, we develop categories and do pareto analyses of complaints. However, in the final analysis, it is the one-on-one contact with the customer from the director down to the engineer that is the most important. Not only do we elicit those ideas that are closest to the customer, but we create an atmosphere whereby the customer knows we are serious about improving our customer service and satisfaction. What does not show up in any survey or metric is probably the customers' most frequent comment. They know we will do an excellent job satisfying their expected requirements, but what they especially appreciate is how we satisfy their unexpected requirements. Sometimes it is individual performance and sometimes it is organizational performance, but it is always a can-do attitude for the customer!

7.5 Customer Satisfaction Comparison

7.5.a

The comparison of KSC customer satisfaction with other NASA Centers is shown in Figure 7.5.a.1. KSC compares quite favorably, and our focus on customer satisfaction is evident.

We believe that it is important to compare customer dissatisfaction. Figure 7.5.a.2 shows results of the NASA Customer Support Team analysis that was completed in 1992. The team was composed of a number of NASA suppliers, as well as several customers. In addition, structured presentations were given by over 25 customers describing their views of the strengths and weaknesses of the payload integration process. The results were widely supported by the customer community and, although they are not quantitative, they do provide a comparison to other organizations within NASA. As shown in the figures in Sections 7.2.e through 7.5.a, we have made remarkable improvements in prob-

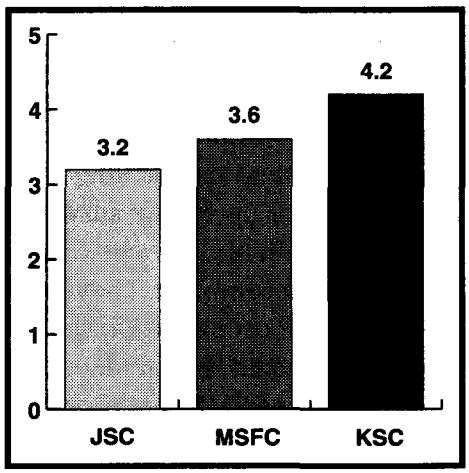


Figure 7.5.a.2–KSC enjoys high payload customer satisfaction rating

lem areas and now receive high ratings in all areas.

In addition to the excellent fiscal performance presented in Section 6, KSC's prompt payments show KSC to have the best contract administration performance compared with the record of all NASA centers. KSC also received five procurement awards from NASA Headquarters, including awards in small and small disadvantaged business utilization and small business innovative research.

A recent poll taken in Brevard County, the home of KSC, by the Florida Today newspaper surveyed confidence in public institutions. As shown in Figure 7.5.a.3, KSC scored near the top of the public opinion poll when compared with other local institutions.

At the recent celebration of the NASA Heroes of Reinvention, held at NASA Headquarters, Vice President Gore said, *"More than simply words are going on at NASA... The Payload team has focused on customer service... three years ago, customers rated 40 percent of the services less than satisfactory... today, every single one of those low-rated services has been brought up to par as measured by the customer, and Shuttle and payload processing are continually improving."*

These dramatic improvements lauded by Vice President Gore and others are a direct result of the KSC team focus on customer satisfaction and quality performance.

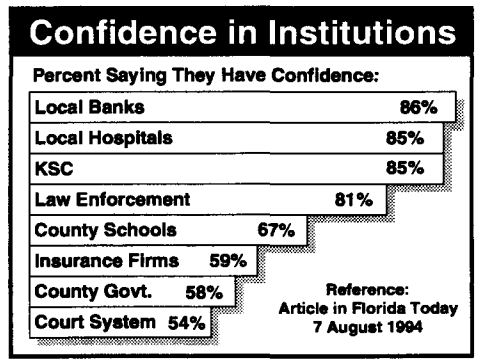


Figure 7.5.a.3 — The public has a high level of confidence in the Kennedy Space Center

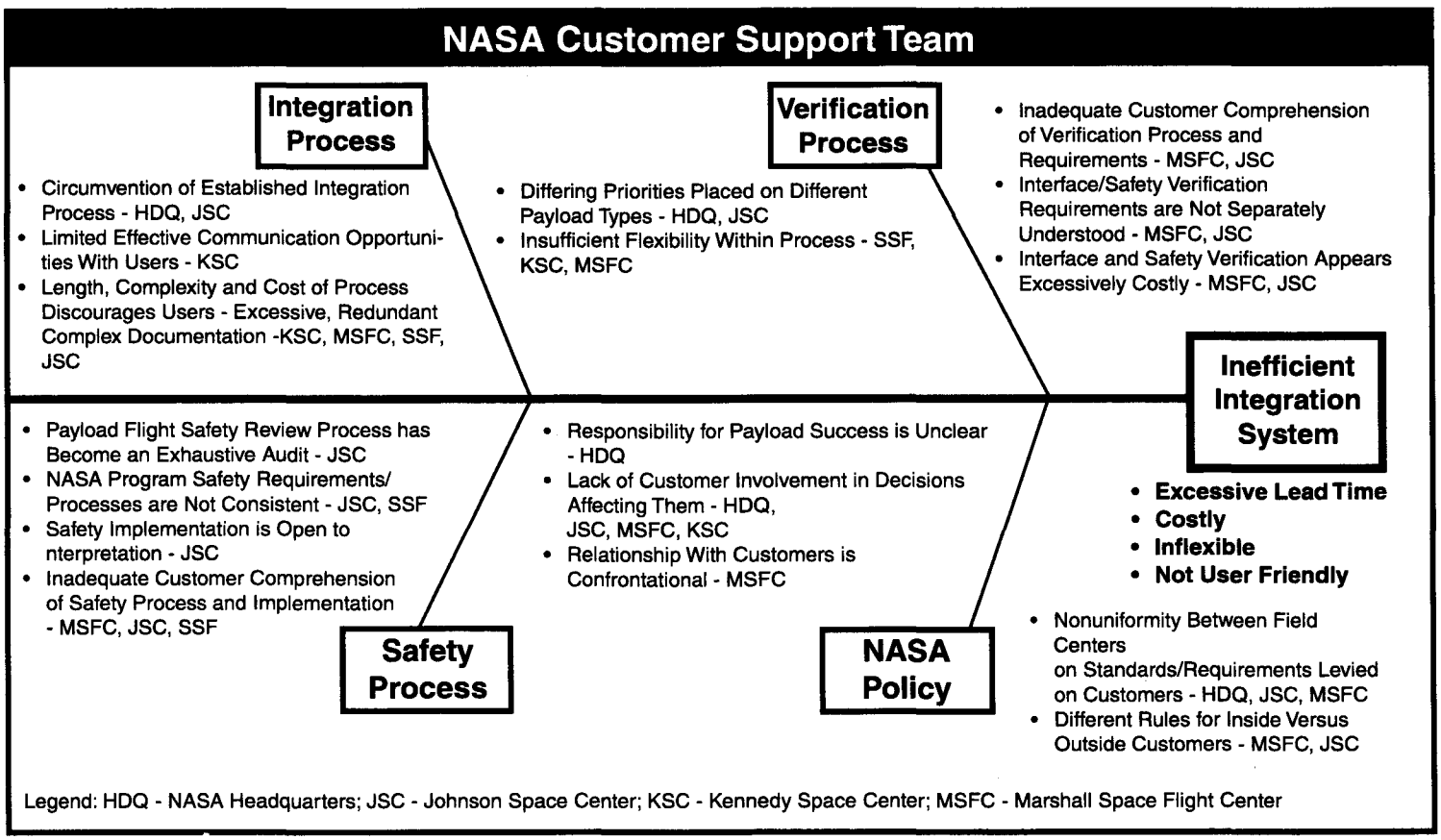


Figure 7.5.a.2 — Customer Support Team Analysis Process has improved customer integration

Glossary of Acronyms

Acronym		First Used on Page
AARS	Associate Administrator Review Status	16
ADTA	Air Data Transducer Assemblies	37
AIT	Analysis and Integration Team	5
CFC	Chlorofluorocarbon	8
CI	Continual Improvement	ii
CIAO	Central Industry Assistance Office	9
DAAWG	Disability Awareness and Action Working Group	8
GSE	Ground Support Equipment	31
IPT	Integrated Processing Teams	5
KSC	Kennedy Space Center	i
MSC's	Material Service Centers	55
MPS	Mission Processing Session	6
NASA	National Aeronautics and Space Administration	i
NPR	National Performance Review	iii
OPF	Orbiter Processing Facility	i
OPM	Office of Personnel Management	28
PDT's	Procurement Development Teams	35
PLDD	Property Loss, Damaged, or Destroyed	14
Q+	Quality Plus Teams	3
RFP's	Request for Proposal	35
RTAT	Rapid Turnaround Time	37
SDB	Small Disadvantaged Business	35
SEB	Source Evaluation Board	35
SFO	Search for Opportunities	23
SPC	Shuttle Processing Contractor	30
SPECSINTACT	Specifications Kept Intact	31
SRB	Solid Rocket Booster	31
STS	Space Transportation System	29
TDRS	Tracking and Data Relay Satellite	Inside Cover
TQM	Total Quality Management	iii
TPS	Tile Processing System	32
WTRS	Water Treatment and Recycling System	8

National Aeronautics and
Space Administration
Office of the Administrator
Washington, DC 20546-0001

SEP 12 1995

Mr. Jay F. Honeycutt
Director
Kennedy Space Center
National Aeronautics and
Space Administration
Kennedy Space Center, FL 32899-0001

Dear Mr. Honeycutt:

Congratulations to you and the entire staff of the Kennedy Space Center on your recent outstanding achievement of being awarded the President's 1995 Quality Improvement Prototype Award. Vice President Gore's personal presentation of this most prestigious award recognizes the exceptional efforts that Center employees have exerted in adopting the continual improvement quality philosophy and techniques in all of their activities and endeavors. Such achievement demonstrates the leadership required of all NASA in this turbulent time of change and reduced resources. Only through the application of improved methods of management, employee empowerment, and data-driven decision-making can we achieve NASA's goals for the future.

Kennedy Space Center's demonstrated ability to excel as a true quality organization, and to be recognized and honored as one of the top five quality organizations in the Federal Government, is inspirational to all others throughout NASA, across Government, and among our partners in the private sector. All of NASA supports and applauds the Center's outstanding quality achievement and looks forward to understanding and sharing more fully its continual improvement approaches and techniques.

NASA is most proud of your accomplishments, and we join with you in celebrating your receipt of this most prestigious Presidential Award.

Sincerely,

Daniel S. Goldin
Administrator

National Aeronautics and
Space Administration

John F. Kennedy Space Center